GAS JOURNAL

LIGHT ⁘ HEAT ⁘ POWER ⁘ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

PROPRIETORS: WALTER KING, LIMITED. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

Telephone: Central 6055. —— Telegrams: "GASKING, FLEET, LONDON."

VOL. CLXXXIV. No. 3421.] WEDNESDAY, DECEMBER 12, 1928. [80TH YEAR.

Editorial Notes.

Coal Selling "Schemes" and Trustification.

THE widespread appeal on behalf of the distressed coal areas, which has been so prominent a feature of all sections of the Daily Press, requires no endorsement on our part. The circumstances which are prompting it have been clearly enough set-out. The story is sufficiently bad to make us, while we are doing what we can to help, forget the past, whatever may be our individual views as to the contributory causes of the decline of our once supreme coal industry. It is never inopportune, however, to look to the future, by taking stock of what effort is being made to revive the prosperity of the past.

Surveying the general reports from all districts during the last month or two, we cannot help being struck with the more hopeful tone, and the feeling in many quarters that prospects are better of recovering some of our lost markets. British costs of production have been greatly reduced, and by means which are strictly in accord with sound economic principles. Our competitors have gained and hold a great deal of the trade which used to be ours, by means of direct, or very thinly disguised, subsidies. These have been maintained far longer than was anticipated; but there is reason to believe that at last sound economics are beginning to come into their own. It is to be hoped that the coal trade of Great Britain will really rise to the occasion, and thrust home any gains that it may be making. It has had tremendous difficulties to contend with since the war; but there is undoubtedly a general idea that it has been unequal to the struggle—that however extravagant may be some of the accusations of the workers, however futile their suggested remedies, there is a deal of fire somewhere to account for the smoke. The one big constructive effort to reduce costs was nullified, or at any rate its benefit deferred, by the ruinous stoppage which was required to carry it. But costs are lower, and they are being helped still further by the bringing forward of the de-rating scheme, by which some measure of relief is given as from the first of this month through the railway rates on export coal.

Little has been heard until recently of any serious effort to improve the sales organization of the coal trade, and we are not alone in the opinion that it has not yet assimilated modern ideas of salesmanship. Now attention has been turned in this direction, and the formation of the so-called Five Counties Scheme has been followed by meetings of all districts under the auspices of the Mining Association, in an endeavour to evolve an organization for each, and co-ordinate them so as to eliminate unnecessary competition between districts. Some are finding immense difficulties in drawing-up any scheme at all; and, with the many units which compose each coalfield, it can be understood that any basis of output restriction acceptable to all parties is going to take a great deal of finding. Many of the collieries are frankly suspicious that political pressure is behind the whole idea—that, in fact, Headquarters are being urged to do something, and do it quickly. We understand that some districts are making very little headway, and at the best a restrictive scheme could hardly be more than a temporary measure.

What is unintelligible and disappointing is that so little progress is being made with grouping and amalgamation, which were given so much prominence in the Samuel Commission findings. Economies in working, in the pooling of seams and of rolling stock, have been stressed; but of equal importance, surely, would be the vast improvement that could be made in selling organization. It stands to reason that powerful groups controlling substantial outputs would be a far greater force in the export markets than the innumerable small units, who are at present too often competing with one another with identical coals, for business which has been taken speculatively by export merchants. Let the merchants speculate if they will; but if they do, let them really take the risk, instead of being, in all probability, in a position to find at least one weak colliery which will cut the price for them. It is an old argument as to whether or not the exporting merchant serves a useful purpose. The true answer probably is that some do and others do not. But surely the ideal is a group of collieries big enough and strong enough to maintain its own Continental offices, and to sell its own coal in such bulk that no middleman is necessary. Undoubtedly, far more could be done in this way to improve selling than by quota and restriction schemes, and it is very questionable whether any workable scheme will be evolved while the multitude of small concerns still exist in certain districts.

Since the collieries show little inclination to group themselves even in the most obvious cases, it really seems that sooner or later someone will have to do it for them. One of the favoured arguments of the coalowners for a continuance of their seemingly prized isolation is that an amalgamation of liabilities will produce no assets. After so many bad years, money is hard to raise within the industry, but we believe that there are many instances where grouping would be likely before long to produce very definite assets in the shape of profits, and that the comparatively small amount of capital that would be required at the present moment might prove an excellent investment. We read in works on finance that the financier invests in an industry when it is depressed. The coal industry has been in depression long enough. It professes to see signs of better things. Is not this the financier's opportunity, if finance is the great obstacle to a considerable measure of trustification? And we will be so bold as to suggest that where other objections are raised they are far more often than not indefensible, where a great national industry is at stake. The Mining Industry Act of 1926 makes suitable provision for dealing with such cases.

Refractory Materials.

LAST week we published a forceful paper on refractory materials by Mr. A. T. Green, who lectured on this subject before the London and Southern District Junior Gas Association at their November meeting; and in later columns to-day will be found a paper entitled "Refractories in the Gas Industry," which Dr. E. W. Smith and Mr. H. M. Spiers contributed to the proceedings of a joint meeting of the Bristol Section and the Fuel Section of the Society of Chemical Industry last Thursday. Both contributions are of outstanding interest, and many of the conclusions and suggestions set out in each are similar. Of course, all gas engineers are aware of the important bearing which refractories have on the economics of the gas-making process; yet we think we are not far wrong in stating that the attention paid to the literature of the subject is disproportionately small in view of the fact that, while good refractory materials may account for a cheap supply of gas, poor materials either mar profits or result in bigger gas bills. The appearance of published research work on the question is hardly attractive; a series of graphs which demonstrate one property of a refractory is followed by another series which appears contradictory. Curves cross and re-cross one another with disturbing contrariness, and nothing is clear-cut and simple. There are so many conflicting influences at work when a refractory is being heated to a temperature of (say) 1300° C. on one side, and is being scraped by coal and coke on the other, that there is an unfortunate but inevitable desire on the part of many harassed gas plant managers to cling rather too desperately to methods which served well enough in the past, but which are neither scientifically nor practically efficacious at the present day.

Recent years have witnessed a trend towards higher and still higher temperatures of carbonization—not only to give larger throughputs and a greater gaseous yield of coal gas per ton of coal treated, but to render the steaming reaction, which is endothermic, more efficient. Comparatively recently Mr. Stephen Hay (see "JOURNAL" for Nov. 23, 1927, p. 538) stated that, whereas in horizontal retorts a yield of 63 therms of coal gas per ton of coal carbonized was obtained at a combustion chamber temperature of 1100° C., the figure at 1370° C. was 71·5 therms. The simplicity of this observation ceases immediately the matter of refractories comes to be considered, for as the temperatures of carbonization have been raised, so the demands made upon the materials of which the settings and retorts are constructed have increased. The authors of each of the two papers under review observe that, while fireclay will still be employed for comparatively low carbonizing temperatures, for high temperatures silica is not only desirable, but essential; and because of this observation, it is natural that they should carefully indicate, in the light of modern laboratory research and modern large-scale plant operation, the essential differences between silica and siliceous and fireclay materials, and show how the vices of silica may be subdued, and how its virtues may be comprehended, increased, and skilfully applied.

We suggest that the reason for much erstwhile disgust or impatience with silica is to be found in a lack of clear understanding of its behaviour under various temperature conditions. The impatience on the part of the user was aggravated by the fact that early silica bricks were seldom uniform in quality and were often unsatisfactory. Silica is a complex substance, and needs the most careful treatment. Dr. Smith and Mr. Spiers, after one of the clearest expositions which we have yet encountered on the various modifications of cristobalite and tridymite, and the effect of volume changes—due to the conversion of quartz into one or other of its polymorphic forms—in relation to permanent expansion and other practical questions, observe that the finest silica brick would be one consisting solely of tridymite. Unfortunately, they add, the complete conversion of quartz into tridymite requires prolonged soaking at a high temperature—which fact renders the all-tridymite brick by no means a commercial proposition.

The selection of a suitable refractory must essentially be in the nature of a compromise. For example, a uniform brick of fine texture gives the greatest resistance to chemical attack; unfortunately, a brick of such a texture is not best suited to withstand spalling—and so on. Dr. Smith and Mr. Spiers, however, clear away much confusion, and offer the gas engineer extremely valuable advice not only on the actual selection of the refractory, but also as to its success in operation. Here, for example, are four important maxims: Insist on the supply of silica bricks of low specific gravity, to avoid the development of strains and permanent expansion at working temperatures; when the setting is put into use, heat it up slowly, so that the inversion points may be passed in safety; at all times maintain the temperature above 600° C., to avoid volume changes due to inversion, and to prevent spalling; and when it becomes necessary to shut-down a setting, let the cooling be slow.

In both papers there appear statement after statement and suggestion after suggestion regarding the satisfactory working of retort settings. Without going into any detail here—though it is difficult not to comment on some of the novel thoughts expressed—we are greatly impressed by the dual nature of the problem of refractory materials. Not in vain has the gas industry expected much and demanded much of the refractory manufacturers; in turn, it must explain to the latter more explicitly what are its requirements. Do we know, for instance, exactly what is wanted in the refractories of each zone of a vertical retort? Is it desirable to vary the constitution of a jointing cement according to the temperature effects of, and physical condition of the charge in, these different zones? In every case, is due account taken of the local peculiarities of a particular installation or a particular method of working? Are proper allowances made for the chemical composition and physical properties of the coal or coals carbonized in a definite plant? Everything points to the validity of Mr. Green's emphasis on the necessity for continued research into the problems of the manufacture and utilization of refractory materials for gas-works. "Though the work of research associations is a great and necessary help towards the solution of the problems," he remarks, "the collection and collation of data by the technical staffs of contracting firms and individual gas plants are usually vital to a successful issue. Truly the problem of refractories for gas-works will only be satisfactorily solved by the application of the ideal of mutual help as essential to industrial progress"—on which point we heartily agree.

The Britisher Abroad.

UNKIND things have been often said of the international commercial methods of the Britisher, but still he has gone along in his own way—and prospered. It is, perhaps, this very prosperity which has led him unduly to delay closer conformation to the changed conditions of the times. For there can be no doubt that things have changed, and that they will continue to do so. Competition is keen now in directions in which there was formerly none, and it is keener to-day where it existed before. Progress has been made in various directions towards meeting this altered state of affairs; but there is clearly room for much further improvement in British methods of salesmanship.

These reflections arise out of the study of a report recently issued by the Department of Overseas Trade on the conditions and prospects of British Trade in India, which was prepared by Mr. Thomas M. Ainscough, C.B.E. (H.M. Senior Trade Commissioner in India and Ceylon). A good deal has been said lately about the importance of the new and scientific methods of marketing which are demanded by modern conditions. Mr. Ainscough is of opinion that this need for improved marketing systems lies at the heart of the British trade position to-day in India—and there should be no reason to suppose that if this is true of India, it is not equally so of other places. The *crux* of the matter is, he says, adequate representation. For the past ten years he has consistently emphasized in his reports the fact that the British manufacturer can no longer afford to leave the marketing of his products entirely in the hands of others, but must himself take an interest in, and generally supervise the processes of, selling, propaganda, and advertising until the goods actually reach the ultimate consumer. It is disquieting to learn his conviction, which is based upon more

than twenty years' business and official experience in two of our greatest markets—India and China—that the marvellous industrial strength of the United Kingdom is to a large extent dissipated, and that British manufacturers fail to obtain their due share of the trade of the East owing to the fact that our marketing methods are not so scientific or carefully planned, having regard to the needs of each country, as our methods of production.

A warning of this character, from an authority so competent to pass a sound judgment upon the situation, should not in any event be permitted to pass unheeded, but the value of criticism is in the present instance inestimably enhanced by the pointing out of a remedy. Though the number of efficient, modern selling organizations adequately covering the Indian market and making full use of present-day propaganda and advertising may be extraordinarily few, there are some gratifying exceptions. For example, the manufacturers of heavy machinery and plant of all kinds, we are told, have in most cases established their own branches, staffed with both commercial men and engineers. The majority of firms, however, have been content to leave the whole question of selling and distributing methods entirely in the hands of their mercantile agents in India—not realizing that these people have, as a rule, far too many irons in the fire to give close personal attention to any one agency, unless they are assisted and prompted to do so by the manufacturer. The remedy, Mr. Ainscough adds, is for the producer to take a personal interest in the market, and to realize that, without the expenditure of capital and trouble, he cannot hope to have his goods adequately distributed. Though India is specifically referred to in this report, the lesson which it conveys may have far wider application; and therefore we commend it to the close attention of British manufacturers engaged in export trade.

Low-Temperature Carbonization at the Pithead.

With the usual prominence that accompanies low-temperature news, it was announced in the Press at the end of last week that Continuous Coal Carbonization, Ltd., have concluded an agreement with one of an important group of North-East Coast Collieries for the erection of a unit of their plant to deal with 5000 tons of coal a day. A suitable site is to be allotted, and the coal is to be sold to the C.C.C., Ltd., on an agreed cost *plus* profit basis. The excellent export facilities are mentioned in the announcement, and also the suitability of the district for local sales, though we should have been inclined to doubt the popularity of the new smokeless fuel in a North Country mining area. Our inquiries on the Newcastle market have so far failed to disclose any further details, either as to the colliery concerned or even what class of coal it is proposed to deal with. While we understand local opinion is frankly sceptical, and declares that it will believe it when it sees it, we can only congratulate the firm on their enterprise and faith in planning such a large project, and the colliery which has a prospect of selling some million-and-a-half tons a year at an assured profit. We do not think there are many in such a happy position today.

The Empire as an Economic Unit.

Time was when the much-vexed question of free trade or protection was more or less relegated to political circles. Our country enjoyed a lead then in industrial development which permitted this treatment of a vital problem. Now, under the stress of international competition, all this is altered, and it is realized as everybody's business to discuss a matter which was formerly so largely left to theorists. This must be so, if there is truth in Lord Melchett's warning that it is the pound sterling rather than the Flag which will eventually keep the Empire together. To him it appears that many of Britain's problems could be solved by converting the Empire into an economic unit. Over-industrialized Great Britain, he argued, can only restore her balance by exchanging manufactures for agricultural products and raw materials from the great areas within the Empire. The problem is not new; but it has become more acute now than at any other period of our history. There has been a great increase in inter-Imperial trade. In 1913 the British Possessions supplied 27·6 p.c. of British imports; in 1927, 30·1 p.c., and for the first nine months of this year, 31·3 p.c. In the export trade of British produce and manufactured goods there has been an equal rise. For instance, in 1920 the Empire took 41½ p.c.; by 1927, it had increased to 47 p.c. It will be seen that the Empire takes nearly half of Britain's total exports; while Britain imports less than one-third of her requirements from the Dominions. Last year our imports from the Empire totalled £420,000,000, and our exports to the Empire totalled £380,000,000. There has been a genuine increase in Empire trade in tonnage as well as in cash.

A Way to Industrial Peace.

Every little that may help to bring employers and employed closer together is to be welcomed; and therefore we feel grateful to our contemporary, the "Evening News," for having drawn attention to the adoption by an engineering firm of the principle of Employee Directors. True, the discovery of this method of securing industrial peace is somewhat belated, as the system of granting seats at the Board to representative Employee Directors was inaugurated many years ago by the South Metropolitan and South Suburban Gas Companies. The "Evening News" says it will be interesting to see how the scheme works out in practice. There need be no doubt on this head. Properly drawn up, and fostered by mutual goodwill, the principle is full of advantage to master and man. As we have seen it operate in the two Companies, we cannot speak too highly of it. At its inception, it was a bold stroke devised by a great mind; and it has been deservedly successful. To those already practising the principle, an addition was foreshadowed by the Act (reviewed on p. 664 of last week's issue of the "JOURNAL") which the Yorktown (Camberley) and District Gas and Electricity Company obtained from Parliament this year.

Long-Distance Gas Supply in Germany.

In the Report by Mr. J. W. F. Thelwall (Commercial Counsellor, Berlin) on the Economic and Financial Conditions in Germany (to June, 1928), recently issued by the Department of Overseas Trade, some interesting particulars were given of developments to date in the long-distance gas supply schemes, particularly that of the Ruhr Coal Syndicate. Their subsidiary, the A.G. für Kohleverwertung, which, incidentally, is changing its name to Ruhrgas A.G., is at present busy laying its first big pipeline—a length of about 14 miles—from Dortmund to Plettenberg. Over the first half of the distance the diameter is 700 mm. [27·6 in.], and 600 mm. [23·6 in.] on the second half. The pipes are 16 metres [52 ft.] in length, and of a thickness of 8 mm. [0·31 in.], and they are water-gas welded on the spot into lengths of 120 to 200 metres [393 to 656 ft.]. It is interesting to note that, on the basis of the section already completed, the cost is expected to work out at Mk.50,000 per kilometre, or rather over £4000 a mile. As plans are drawn up to spread the system over practically the whole of Germany, the capital outlay envisaged must be stupendous. The report from which we are quoting gives particulars of some of the contracts already secured, and cites some of the advantages claimed for the scheme by its sponsors. We would point out, however, that it is liable to be somewhat misleading to those whose only source of information on the subject it is. As has been shown in our columns on various occasions, the claims and figures of the Syndicate are very extensively disputed by the established gas industry in Germany, which believes the very low prices at which gas has been offered in the contracts already made cannot possibly show an adequate return or become universal, but have been fixed merely with the object of making a start. The final realization of the entire scheme is, we read, no doubt dependent upon some equitable arrangement between the older suppliers of gas and the A.G. für Kohleverwertung. We have shown, in recent articles, how very little progress is being made in this direction.

"Gas Salesman" Supplement.

Published as a Supplement to this issue of the "JOURNAL," the "GAS SALESMAN" to-day contains three lively papers, read at "B.C.G.A." Circle meetings, on subjects of interest and importance—coke sales, refrigeration by gas, and the surface combustion method of gaseous heating.

PERSONAL.

Sir RUSSELL BENCRAFT, M.D., Chairman of the Board of the Southampton Gas Light and Coke Company, sailed last Friday for South Africa, under medical advice, with a view to re-establishing his health, which has not been satisfactory for some time. He is expected to return to England in February.

At a Board Meeting of the Imperial Continental Gas Association on Dec. 5, a pleasing ceremony took place; Col. H. LE ROY-LEWIS, C.B., C.M.G., D.S.O., the Chairman, being presented with the Association's long-service medal on the completion by him of 25 years' service with the Association, and receiving the warm congratulations of his fellow Directors. Col. Le Roy-Lewis was appointed a Director of the Association on Nov. 25, 1903; being elected to the position of Deputy-Chairman in May, 1921, and succeeding to the Chairmanship on July 25 this year. The London and Continental staff had previously taken the opportunity to convey to the Chairman their good wishes and their appreciation of the cordial relationship which has always existed between him and the staff.

Mr. THOMAS CARMICHAEL, Engineer to the Portsmouth Gas Company, Member of Council of the Institution of Gas Engineers, has been elected to succeed Mr. Joseph Cash, who has retired from the Board of Directors of the Southampton Gas Light and Coke Company on account of advancing years. Mr. Cash is retaining his position of Director to the Brighton and Hove General Gas Company.

After 45 years' service with the Ventnor Gas and Water Company, Mr. J. S. INESON has retired from the post of Secretary and Manager at the age of 80 years. Though he has given up active participation in the Company's interests, he will still act in an advisory capacity. Mr. Ineson was born at Scarborough and trained at Malton. In the early 'seventies he went out to Brazil, and was engaged on the erection and construction of several complete gas-works. He came to Ventnor in December, 1883, and soon afterwards took over control of the Ventnor Company. He had many difficulties to contend with during his tenure of office, but he has surmounted all with characteristic energy; and the favourable position of the Company to-day is in no small degree due to his business-like and careful management.

Mr. F. H. JAMES, formerly Secretary to the Imperial Continental Gas Association, has been appointed General Manager, and Mr. W. E. BOWERS, formerly Assistant Secretary, has been appointed Secretary.

The following have been elected members of the Society of Chemical Industry: Messrs. F. J. DENT, A. WILSON, and J. W. WOOD (Fuel Department, University of Leeds), and H. H. THOMAS (Liverpool Gas Company).

At the first annual dinner of the employees of the Ludlow Gas Company, under the chairmanship of Mr. H. W. Green, Mr. H. J. DEAN, a former Manager, was presented with a smoker's cabinet by Mr. J. Bryan (Director).

OBITUARY.

We regret to announce the death, at Cambridge, on Dec. 7, of Mr. JAMES W. L. GLAISHER, D.Sc., F.R.S., Senior Fellow of Trinity College, Cambridge, who was 80 years of age. The funeral service took place yesterday (Tuesday) in Trinity College Chapel. Deceased, like his father, was a Director of the Barnet District Gas and Water Company, and also of the Hemel Hempstead Gas Company.

The death has taken place, at the age of 84 years, of Mr. JAMES MARLOW, a Director of the Bewdley Gas Company.

Bowling and Golf Clubs of Messrs. Alder & Mackay, Ltd.

The New Grange Bowling and Golf Clubs, whose members are recruited solely from the employees of Messrs. Alder & Mackay, Ltd., held their annual dinner on Friday, Nov. 30. Mr. H. E. Bennet, the Company's London Managing Director, presided, and was supported by the other members of the Board. After the Loyal Toast had been duly honoured, the Chairman commended the Clubs on their various achievements during the past season, and presented the prizes. The Secretaries of the Clubs expressed their heartfelt appreciation of the interest taken in them by the Board and the staff. They considered that the handsome prizes presented did much to foster the competitive spirit which enabled them to secure and retain a large proportion of the open trophies. A good musical programme followed, which was enjoyed by all present.

IN MEMORY OF THOSE WHO FELL.

South Metropolitan Co-Partners at Southwark Cathedral.

ON Saturday last a commemoration service was held at Southwark Cathedral in memory of the 386 members of the staff of the South Metropolitan Gas Company who made the supreme sacrifice in 1914-18. More than 2000 co-partner employees attended the service; and there was a march by 700 ex-service men headed by the Metro-Gas Band.

ON THE ELECTRICAL SIDE.

West Midland Scheme.

The announcement is made that the Electricity Commissioners have sanctioned the construction of a new power station on the River Severn at Ironbridge, Shropshire, and have authorized the borrowing by the West Midland Joint Electricity Authority of the provisional sum of £700,000 on account of the estimated cost of £960,000 for the first section. It is anticipated that four sets of 50,000 KW. each will be required for the station. The estimated cost will be nearly £3,000,000. The first section will be completed towards the close of 1930, and the whole scheme in about twelve years. Instead of providing for the West Midlands alone, as planned originally, the Ironbridge station will become one of the principal base load stations for Central England.

Domestic Electrical Safety.

The times when cases arose of persons attempting to "blow-out" a gas light are now receding well into the past, though probably many readers will be able to recall one or more instances of gas lights being in this way successfully extinguished—with disastrous results. Education of the public at large—invariably a desperately slow process—was needed in the case of gas; and there has been time for it to be accomplished. Similar education is still required in connection with electricity; and the difference in age no doubt provides sufficient explanation of this. Emphatic warnings have been issued as to a misuse of electrical apparatus which was responsible for two recent fatal cases at Woolwich and Croydon, through portable radiators being placed in bathrooms; but it is clear that yet other warnings are called for. Expressing, in a letter to the Press, views which he points out are his own, and not necessarily those of his Association, Mr. W. H. Walton (President of the Electrical Contractors' Association) says it is undoubtedly high time that the public was given a clear lead on the commonsense handling of domestic electrical equipment. The simple safety of a detached lighting system has been left behind; and the industry is now "putting electrical equipment (at advanced pressures) literally into the hands of the public," and is "inviting them to use these equipments on concrete, stone, and tiled kitchen and scullery floors, and in the presence of large masses of earthed metal, not only in the bathroom, but in various rooms and passages, via the central heating radiators and other engineering features to be found in all modern residences." The question, so far as Mr. Walton is concerned, is not as to the necessity for such warnings, but by whom they should be given. Unless electricians are able to get together on the subject, he anticipates some very difficult times in the near future on this matter of domestic electrical safety.

"Hidden Risks."

Another direction in which it is equally necessary for the electrical industry to put the public on its guard is referred to in a leaflet entitled "Hidden Risks" which has lately been issued by the National Register of Electrical Installation Contractors. The object of the leaflet is to draw attention to the advantage of having installation work carried out by persons or firms whose names appear on the register; and it explains in simple manner the risks which are inseparable from work done by unqualified contractors. The following quotation from the leaflet sufficiently indicates the nature of these risks: "Hidden away in walls and under floorings in house, shop, and factory is a maze of wires whose purpose is to conduct electricity to the points where you convert it into light and power at the touch of a switch. Generally the quality of materials and workmanship employed are beyond reproach. On the other hand, it is still unfortunately possible to find untidy bunches of wire amateurishly tied-up with odds bits of tape and string. Such work is definitely dangerous, and the risk is enhanced by reason of the fact that it is hidden away, so that you may never have seen it or even given it a thought. How to insure yourself against the risk of breakdown—and even fire? Consult a qualified electrical installation contractor, and remember that, as so much depends on the way this work is done, the cheapest offer is not always the most satisfactory in the long run."

Wages of Electricity Workers.

The National Joint Council of the Electricity Supply Industry have arrived at a settlement in the matter of the wages claim in which the unions had asked for the abolition of the cost-of-living sliding scale, a 10 p.ct. increase of district rates, double-time rates on Sundays for shift workers, and new rates for certain specified grades of the operative staffs. In the first place, the employers opposed the increases, and insisted upon reductions, whereupon the unions asked for the reference to the Industrial Court of the matters in dispute. This proposal they subsequently modified to a suggestion for the continuance of the existing wage rates for a further period of twelve months, except in respect of the specified grades for whom they desired new rates. They intimated that at an early date they would proceed to frame a scheme for the regulation of wages, and would submit it to the employers. These suggestions were accepted by the Joint Council, which also arranged that the Negotiating Committee of the Council should deal early next year with the wages of the specified grades.

The Unlucky Month.

Most gas undertakings in this country have now passed their century, without being "out;" but the same cannot be said of the electricity undertakings, none of which can claim to have reached the century, and many of which cannot claim to be "not out." In the matter of being "not out," December is a somewhat bad breaker of records for our electrical friends. They cannot help this, of course; and when one considers how slight a fault can put a whole district in darkness, the wonder is, not that there are so many failures, but that there are so few. When they do occur, the utmost promptness is exercised in correcting the trouble, so that the period of inconvenience may be reduced to its lowest limit. Possibly the fact is connected with the heavy load, but December appears to be the "unlucky month" so far as Newport (Mon.) is concerned. The Managing Director of a big local business firm has written to the Press pointing out that a breakdown of the electric light service of the town occurred on Saturday afternoon, Dec. 1, and that a similar serious failure happened in December of last year. On the present occasion the service was only partially restored in half-an-hour; and, as the writer of the letter points out, such a stoppage, at a time when probably all the shops are filled with customers, is an extremely serious thing from the business point of view. He does not, however, confine his letter to the making of a complaint about the service, as the following quotation will show: "A few minutes after the breakdown occurred, I telephoned to the power station, intending to ask how long the failure was likely to last, but, as usual in such an event, could obtain no reply; so one is inclined to presume that at such a time the telephone receivers are systematically removed, to avoid inquiry, with the result that the public, who have to put up with inconvenience, annoyance, and loss, can get no satisfaction or explanation. I have no doubt inquiry will be made into this matter by the Council; and I think that traders will look for some definite guarantee that, in the event of a failure in future, an emergency plant is available for immediate use." Subsequently it was explained that the failure was due to a loss of vacuum on one of the turbine engines; and it was added that the relief machinery was brought into action as soon as possible. To a representative of the local paper in which the letter above referred to appeared, Mr. A. Nichols Moore, the Borough Electrical Engineer, explained that "it was the custom of his department to cut-off the telephones when there was a breakdown, in order that those busy restoring the service might not be worried with a constant stream of calls." After this, it would not be surprising if, on the next occasion, the "calls" were in person, which might prove even more obstructive than an inquiry by telephone. Judging by a discussion in the Newport Chamber of Trade, this telephone incident has made quite an impression. The members may be wondering why it is not possible, upon such occasions, to arrange for telephone calls to be answered by a young lady the value of whose assistance in the repair of electrical machinery—say, a turbine engine—would be negligible. She would be able to give the soft answer which turneth away wrath; but could a young lady be found in Newport brave enough to undertake the task?

FORTHCOMING ENGAGEMENTS.

Dec. 13.—MIDLAND JUNIOR GAS ASSOCIATION.—Meeting in the Council House, Birmingham, at 6.15 p.m. Demonstration of complete gas analysis by Mr. A. R. Myhill, A.I.C., and Mr. E. T. Pickering, B.Sc., A.I.C.

Dec. 14.—MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.—Meeting at Burnley. Paper by Mr. J. H. Clegg, Gas Engineer and Manager to the Burnley Corporation, on "Dry Cooling of Coke by the Sulzer Plant."

Dec. 14.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute, Vincent Square, at 7.30. Paper by Mr. A. T. Gilbert, on "The Evolution of the Gas Meter."

Dec. 15.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting at Leeds University. Paper by Mr. H. J. Hodsman, M.Sc., on "The Radiation from Gas Burners."

Dec. 19.—BRITISH COMMERCIAL GAS ASSOCIATION.—Meeting of the General Committee, 2 p.m.

Jan. 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council meeting in the afternoon.

MR. F. J. WEST'S TOUR ROUND THE WORLD.

Mr. Fred. J. West, as many of our readers are already aware, has just returned from a business trip round the world. Travelling by Gibraltar, Marseilles, Port Said, Suez, Bombay, Colombo, Fremantle, and Adelaide, his first real stopping place was Melbourne, whence Sydney and other important towns in Australia were visited by rail or road.

His intention was to visit Australia and New Zealand, returning by way of Canada and the U.S.A., and not only to inspect as many as possible of the more important gas-works, but to make personal contact with the personnel of the gas undertakings in Australasia and North America, with whom his firm has been doing business for half-a-century. He was able to spend several weeks in Australia, four weeks in New Zealand, and four weeks in Canada and the U.S.A.; and in all he and his wife covered 30,000 miles in the tour.

Mr. West has, during this period, been able to survey generally the more important aspects of the gas industry of the Antipodes, and is able to confirm that its steady development has gone upon sound technical and business lines, and that it has succeeded in overcoming difficulties in many respects comparable with those which confront the industry in the Old Country. Indeed, he found that the competition with electricity is in many ways keener than it is at home, and that gas undertakings "down under" have to face State-controlled electricity undertakings, often with very low-cut charges.

Our colleagues in the Dominions, however, are taking every advantage of our experience at home, of which they eagerly read in the English Technical Press, and are formulating lines of their own in solving the problems arising out of the peculiar climatic and local conditions under which they work.

LOYALTY TO THE OLD COUNTRY.

Mr. West said that the outstanding feature of his visit to Australia and New Zealand was the cordiality and warmth of the reception everywhere accorded to him. It was particularly interesting to meet many men who had received their early training in this country. He and Mrs. West were taken into the "family circle," and made to feel completely "at home." And in the gas industry, as well as in all other circles, they found a tremendous loyalty to the Old Country. On the personal side, he was impressed with the vastness of the distance which separated the different towns of any size in those countries. Few people who have not been privileged to see for themselves can appreciate what this means to the engineer, who must feel very lonely when confronted with problems which one is accustomed at home to discuss with a brother engineer. These problems have got to be tackled and solved without the assistance which is so freely rendered by one engineer to his neighbour in this country, and decisions must be arrived at without the benefit of that second opinion which is not only valuable in itself, but which lightens the burden of responsibility. That friendly chat with a colleague over the changing aspects of gas manufacture and supply must be deferred until the next annual meeting of a local Association, whose members are drawn from areas which appear to an Englishman to be of an appalling size. But despite the long distances which have to be traversed, both in Australia and in New Zealand, there is every indication that the Australasian engineer and manager attaches the full value to meetings and conferences at which technical and commercial matters can be discussed at suitable intervals, comparing problems and solutions, and arriving at agreements upon policy which strengthen the hands of all.

MONTHLY ACCOUNTS.

Mr. West, of course, noted many points of detail, in which practice in both manufacture and administration in Australia and New Zealand differ from those at home. One point in Australia was that gas accounts are generally rendered monthly instead of quarterly. Among arguments advanced in favour of this custom it was stated that the system has resulted in fewer outstanding accounts, and that consequently less working capital is necessary to cover the running expenses of the undertakings. During the return trip—he sailed from Auckland by way of Fiji and Honolulu to Vancouver—Mr. West visited many gas-works in Canada and the U.S.A. Here it was particularly interesting to note the rapidly extending use of gas for central heating, and to a less, but steadily growing, extent for household refrigerators.

A FILM OF THE TOUR.

At the London Offices of West's Gas Improvement Company last week, we were privileged to see a projection upon the screen of the cinematographic record which Mr. West has made of his journey. This interesting miniature film was exposed in a hand camera of the Bell-Howell make, and gives excellent moving pictures on a screen 4 ft. by 3 ft. The films are divided into two main categories, those giving scenes in the gas-works, and those showing scenery and incidents of general and personal interest. In both divisions it was profoundly interesting and satisfactory to see "the living images" of many men and their families who left us years ago to take up their life and work so far away. It brought our friends and their surroundings much closer to us than could possibly be done by any other form of "traveller's tale."

A good many of the features of scenery which were depicted on the screen have already been described in the lively articles which Mr. West has contributed to the columns of "West's Gas" during his trip. It was truly wonderful to see the flying boats, which had come all the way from England, circling high up in the air, and finally alighting like great swans upon the waters of Sydney Harbour. The marvels of the thermal regions of New Zealand, with their giant hot springs and boiling mud, are much more comprehensible when seen in this form. In Canada we were greatly assisted to realize the vastness of the Rockies, the wonderful buffaloes, and the tremendous masses of water—potential power—which fall over at Niagara.

POTENTIAL INVESTMENTS.

XIX.—THE NORTH MIDDLESEX GAS COMPANY.

The North Middlesex Gas Company was established in the year 1862, when it was registered as a limited Company. It was incorporated by Special Act in 1895. Head Office: 5, Great Winchester Street, Old Broad Street, E.C. 2.

The statutory area of supply covers over 10½ square miles, and comprises the Urban Districts of Mill Hill, Hendon (part), Golders Green (part), Church End, Finchley, North Finchley (part), and East Finchley. The consumers number 18,675.

The capital of the Company as shown by the last published accounts (December, 1927) is as follows:

Capital Stocks.

	£
6 p.c. standard consolidated stock	131,780
6 ,, preference stock	30,000
5 ,, ,, ,,	65,000
Premiums received	28,489
Remaining to be issued	169,981
Total amount authorized	£425,250

Loan Capital.

	£
5 p.c. perpetual debenture stock	27,200
4 ,, ,, ,, ,,	17,850
5 ,, redeemable ,, ,,	11,250
7½ ,, ,, ,, ,,	43,550
Remaining to be borrowed	100,150
Total amount authorized	£200,000

Premiums received on debenture stock, £839.

Transfer Arrangements: Common form. Fee for registration of transfer, probate, death in joint holdings, marriage, power of attorney or distringas, 2s. 6d. Stocks (separate deed for each class) are transferable in amounts and multiples of £10. Husband's witness of wife's signature, or *vice versa*, not accepted.

Voting.—One vote for every £10 of standard consolidated or preference stock.

Accounts and Dividends: Accounts and Dividends are made up to Dec. 31, and submitted in February or March, dividends (ordinary and preference) being paid in September and after the annual general meeting. The standard price of gas is 1s. 1½d. per therm (altered from 1s. 4d. in 1926), present price 9·8d. per therm; declared calorific value 500 B.Th.U. per c.ft. Dividends on consolidated stock are subject to sliding-scale—viz., ½d. per therm above or below the standard price equals ⅝ p.c. in year's dividend.

The following table illustrates the progress made by the Company prior to the war and during the past four years. The years 1914 to 1923 have been ignored owing to the abnormal conditions then prevailing.

The original and additional ordinary shares of £10 were converted into stock as from Jan. 1, 1925. As from Jan. 1, 1927, the 10 p.c. and 7 p.c. standard ordinary stocks were converted as follows: Each £100 10 p.c. stock into £166⅔ 6 p.c. standard consolidated stock; and each £100 7 p.c. stock into £116⅔ 6 p.c. standard consolidated stock.

Year to Dec. 31.	Average Gross Selling Price of Gas Per 1000 C.Ft.	Quantity Sold. Thousands C.Ft.	Capital Employed per 1000 C.Ft. Sold.	Gross Profit.	Total Charge for Capital. *	Rates of Dividend Paid P.Ct. per Annum. 10 P.Ct. and 7 P.Ct. Shares.	Amount Carried Forward and Balance Reserve Fund.
	s. d.		s. d.	£	£	£ s. d.	£
1903 .	3 9¾	118,729	16 6	8,074	6,757	10 0 0 7 0 0	8,653
1908 .	3 8	187,466	13 6	9,150	7,985	10 0 0 7 0 0	14,459
1913 .	3 4	284,406	12 5	11,826	11,281	10 17 6 7 12 3	23,301
	Per Therm. d.	Therms.	Per Therm. s. d.				
1924 .	9·5	2,616,017	2 2	18,934	17,502	11 10 0 8 1 0	28,077
						On 10 P.Ct. and 7 P.Ct. Stocks.	
						£ s. d.	
1925 .	10·0	2,865,694	2 1	19,591	20,011	11 10 0 8 1 0	29,405
1926 .	10·67	3,116,187	2 0	19,110	19,520	11 10 0 8 1 0	26,898
						On 6 P.Ct. Con. Stock.	
						£ s. d.	
1927 .	10·92	3,365,877	2 0	31,020	20,425	†6 18 0	30,678

* The total charge for capital includes amount (if any) carried to reserve fund.
† Equivalent to the rates paid for the three previous years.

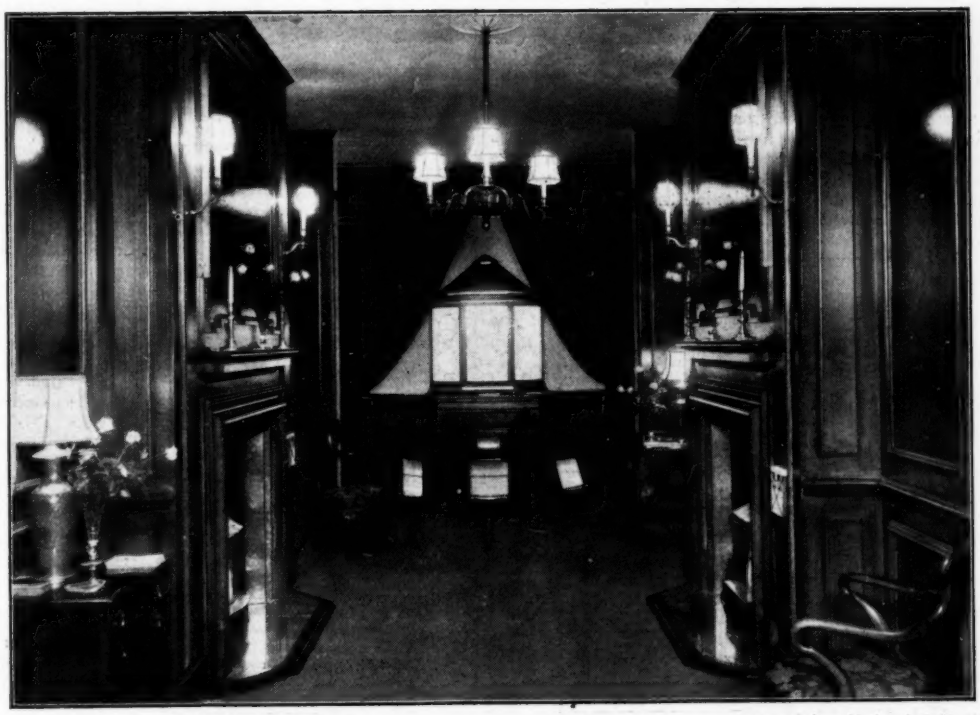
It will be seen that the sale of gas during the year 1927 was 3,365,877 therms, which is equivalent on a 500 B.Th.U. calorific basis to 673,175 thousand c.ft. This compares with 284,406 thousand c.ft. in the year 1913, an increase of nearly 137 p.ct. The steady increase in the business done each year, and the gradual reduction in the capital employed, indicates a strong position, and there is every prospect of further improvements in the future.

The following table shows the highest and lowest prices of the 6 p.ct. standard consolidated stock during the year 1927, and of the shares and stock for the four previous years prior to the consolidation, the dividend paid, and the yield p.ct. per annum calculated on the average price:

—	Transactions. Highest.	Transactions. Lowest.	Dividend.	Yield P.Ct. per Annum on the Average Price.
			£ s. d.	£ s. d.
1923 Original shares	16½		11 0 0	6 13 4
1923 Additional ,,	12⅝	12½	7 14 0	6 2 7
1924 Original shares	..		11 10 0	..
1924 Additional ,,	11⅞	11⅝	8 1 0	6 17 9
1925 Original stock	..		11 10 0	..
1925 Additional ,,	118	116½	8 1 0	6 17 6
1926 Original stock	159	158	11 10 0	7 5 1
1926 Additional ,,	110		8 1 0	7 6 4
1927 Consolidated stock	92		6 18 0	7 10 0

The stock is very closely held, and there were only a few recorded transactions last year. The present average quotation is 104½, at which price the yield calculated on the last full year's dividend is £6 12s. p.ct. per annum. For the half-year ended June 30, 1928, an interim dividend at the rate of £7 1s. p.ct. per annum was paid, yielding £6 14s. 10d. at 104½. The yield is low for a company of this size; and the high quotation would appear to indicate a still higher dividend distribution. The *authorized* dividend for the current year, regulated by the highest price charged for gas, is £8 5s. p.ct. per annum.

GAS LIGHT AND COKE COMPANY'S EFFECTIVE DISPLAY AT OLYMPIA.



THIS photograph is of the display of the Gas Light and Coke Company at the Cookery and Food Exhibition recently held at Olympia, West Kensington. The exhibit consisted of the latest equipment for lighting, cooking, water heating, refrigeration, and heating in hotels, restaurants, boarding-houses, and other catering establishments. As gas heating is now playing so prominent a part in the modernization of hotels, and "gas fires in every bedroom" is becoming a common feature in the advertisements of the leading establishments throughout the country, a special display was provided to show how hotel keepers are heating their bedrooms hygienically without creating labour—and are incidentally increasing their own profits thereby. There was a model hotel bedroom equipped with a radiant ventilating gas fire, and nearby was the unobtrusive little bedroom gas fire meter into which the hotel visitor places the necessary coin whenever instant warmth and comfort are desired. Another part of the exhibit consisted of a hotel panelled lounge hall with handsome fires in beautiful settings, and artistic gas lighting fittings which could be turned on and off by means of switches. This section of the display is shown in the above photograph.

EXPLOSION LIMITS OF TECHNICAL GAS MIXTURES.

By K BUNTE and A. STEDING.

[A Communication from the Gas Institute, Karlsruhe. "Das Gas- und Wasserfach," Aug. 25, 1928.]

In the flame velocity curves of gases, specially characteristic points are those at which the flame velocity or the ignitability itself assumes zero value. The explosion limits are, theoretically, the lowest points of the flame velocity curves, and for the lower explosion limit this is actually the case in practice. But in the branch of the curve which corresponds with excess of gas it is found that there can be a well-defined inner cone for gas mixtures of proportions which theoretically should place them well above the higher explosion limit, and in which ignition, when applied, does not spread. It might be assumed in such cases that heat from the outer flame would help to raise to ignition temperature the layer situated immediately within the cone. In this case the variations of the descending curves from the direction of the higher explosion limit must bear some relationship to the behaviour of the flame in a heated zone, and it might be expected that this would throw some light on the considerable variations noted with various gases. In connection with their experiments on flame velocities [see "JOURNAL" for Sept. 19 and 26, and Oct. 3], the authors, therefore, systematically determined the explosion limits of mixtures of coal gas with increasing quantities of carbon dioxide and nitrogen in the one instance, and water gas in the other. The apparatus employed was very similar to that used by Eitner, only Capo meters were used for the mixing and measuring of the gas-air mixture. The explosions were carried out in an explosion burette, which agreed in length and diameter with that used by Eitner, who proved that size and material very largely influence the explosion limits. The point at which explosion was complete was determined by the contraction in the burette, with the help of a manometer. The proportions of the gas-air mixture were able to be very exactly and quickly regulated with the Capo meters to within 0·1 p.ct. The upper explosion limit could be precisely determined, as the mixture ignited completely throughout, or not at all. At the lower limit, on the other hand, the explosion did not stop suddenly, but the explosion wave passed only partially through the gas-air mixture. The lower limit was taken, therefore, to be half-way through the period defined by the points at which the explosion wave wholly and only partially penetrated the mixture.

As was to be expected, the addition of water gas extends the explosion limits considerably. In the case of inerts, the explosion zone is greater for a gas diluted with nitrogen than with carbon dioxide, since carbon dioxide has the greater specific heat. Hence, with carbon dioxide the cessation of the explosion sets-in earlier than with nitrogen.

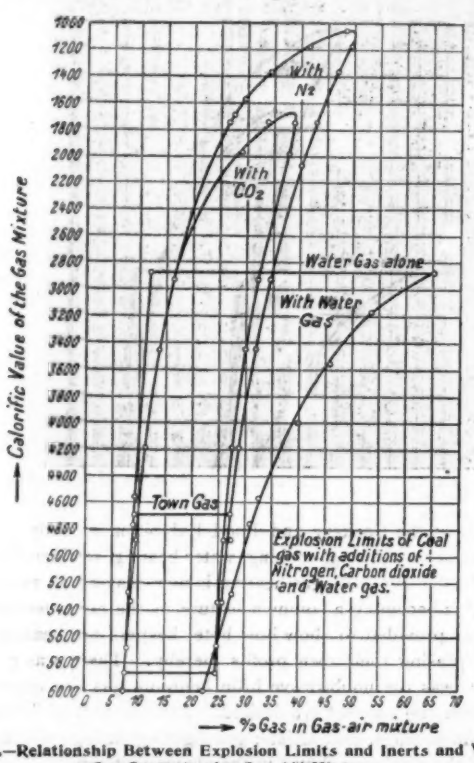

Calorific Value of the Gas Mixture
% Gas in Gas-air mixture
With N2
With CO2
Water Gas alone
With Water Gas
Town Gas
Explosion Limits of Coal gas with additions of Nitrogen, Carbon dioxide and Water gas.

Fig. 1.—Relationship Between Explosion Limits and Inerts and Water Gas Contents of a Gas-Air Mixture.

The values found are set out in the table, and can be seen clearly in fig. 1.

Explosion Limits of Coal Gases with Admixtures of Nitrogen, Carbon Dioxide, and Water Gas.

Mixture.	Kcal./m³.	Lower Limit. No Ignition.	Lower Limit. Ignition Complete.	Lower Limit. Mean.	Ignition Zone.	Upper Limit. Mean.	Upper Limit. Ignition Complete.	Upper Limit. No Ignition.
Coal gas	5860	7·47	7·56	7·50	..	24·5	24·4	24·6
With 9·1 p.ct. CO_2	5330	8·36	8·48	8·40	..	24·9	24·8	24·95
,, 16·7 ,, ,,	4880	9·27	9·33	9·30	..	26·2	26·1	26·3
,, 28·6 ,, ,,	4185	11·20	11·45	11·30	..	27·7	27·6	27·8
,, 41·2 ,, ,,	3450	13·40	13·60	13·50	..	29·9	29·8	30·0
,, 50·0 ,, ,,	2930	16·10	16·30	19·20	..	32·3	32·2	32·4
,, 66·6 ,, ,,	1955	28·70	29·10	28·80	..	37·6	37·5	37·7
,, 70·1 ,, ,,	1750	34·20	33·90	34·10	..	38·75	38·5	38·8
,, 71·4 ,, ,,	1675	Gas no longer ignites at all.						
Coal gas	5860	7·47	7·56	7·50	..	24·50	24·40	24·60
With 9·1 ,, N_2	5330	8·70	8·80	8·74	..	25·65	25·60	25·70
,, 16·7 ,, ,,	4880	9·75	9·86	9·80	..	27·65	27·50	27·80
,, 28·6 ,, ,,	4185	10·80	11·10	10·95	..	28·75	28·70	28·80
,, 41·2 ,, ,,	3450	13·80	13·95	13·90	..	31·80	31·70	31·90
,, 50·0 ,, ,,	2930	16·05	16·25	16·15	..	34·45	34·30	34·60
,, 65·0 ,, ,,	2050	..	..	..	..	40·30	40·20	40·40
,, 70·4 ,, ,,	1735	26·70	26·90	26·80	..	43·10	43·00	43·20
,, 71·0 ,, ,,	1700	27·60	27·90	27·80	..	..	..	..
,, 73·0 ,, ,,	1580	29·40	26·60	29·50	..	..	..	..
,, 77·0 ,, ,,	1350	34·40	34·20	34·30	..	47·00	46·90	47·10
,, 80·0 ,, ,,	1170	41·70	42·00	41·80	..	49·70	49·50	49·90
,, 82·0 ,, ,,	1055	48·40	48·50	48·45	..	48·50	48·50	48·60
Coal gas	6000	7·00	7·08	7·04	..	21·75	21·70	21·80
With 16·7 ,, W.G.	5680	7·45	7·48	7·46	..	24·30	24·20	24·40
,, 28·6 ,, ,,	5280	8·31	8·38	8·35	..	27·90	27·80	28·00
,, 44·5 ,, ,,	4740	8·88	8·98	8·93	..	30·90	30·70	31·00
,, 50·0 ,, ,,	4560	9·13	9·22	9·17	..	32·15	32·00	32·30
,, 66·6 ,, ,,	3990	..	..	..	..	39·95	39·90	40·00
,, 80·0 ,, ,,	3550	..	..	..	..	45·50	45·40	45·60
,, 91·0 ,, ,,	3170	..	..	..	..	53·20	53·00	53·40
Water gas . . .	2870	11·90	12·10	12·00	..	65·40	65·30	65·50
Karlsruhe town gas with high percentage N_2	4670	9·25	9·28	9·27	..	27·75	27·70	27·80

1 kcal. per cub.m. = 0·1124 B.Th.U. per c.ft.

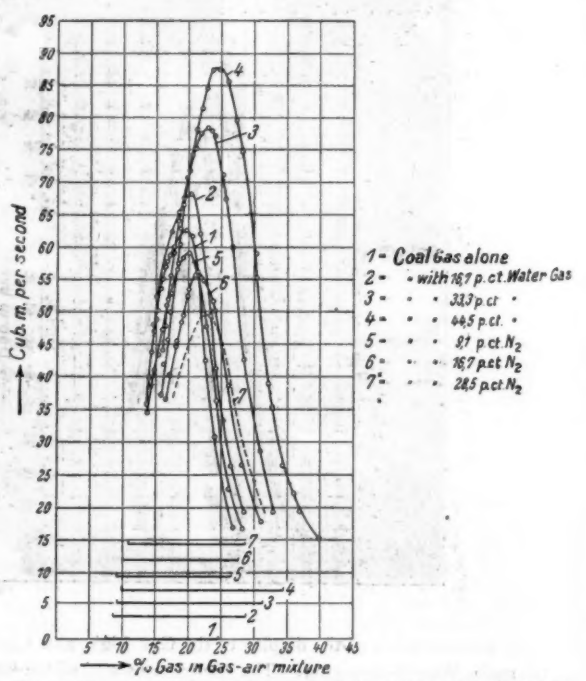

Cub.m. per second
% Gas in Gas-air mixture
1 - Coal Gas alone
2 - " with 16.7 p.ct. Water Gas
3 - " " 33.3 p.ct. "
4 - " " 44.5 p.ct. "
5 - " " 9.1 p.ct. N2
6 - " " 16.7 p.ct N2
7 - " " 28.5 p.ct. N2

Fig. 2.—Flame Velocities of Various Coal Gases over their Explosion Limits.

In fig. 2, the flame velocities of various coal gases are plotted over their explosion limits. It is clear from this that the explosion limits are the starting points for the upward inclination of the flame velocity curves, but that, especially on the side of the upper explosion limits, the flame velocity curve in its lower portion deviates considerably in the direction of excess of gas.

REFRACTORIES IN THE GAS INDUSTRY.

By E. W. SMITH, D.Sc., F.I.C, M.I.Chem.E., and H. M. SPIERS, M.A, B Sc., F.I C. (Research Section, the Woodall-Duckham Companies).

[Paper before a Joint Meeting of the Bristol Section and the Fuel Section of the Society of Chemical Industry, Dec. 6.]

During the past twenty years, carbonizing temperatures in gas-works have been greatly increased; and it is nowadays by no means rare for temperatures exceeding 1400° C. to be attained in the combustion chambers of the settings. High working temperatures offer several advantages, among which may be mentioned increased thermal yield of gas and increased throughput. Stephen Hay ("GAS JOURNAL," **180**, p. 539) has demonstrated that the relation between carbonizing temperature and gas yield is as shown in Table I. for coal carbonized in horizontal retorts.

TABLE I.—*Effect of Temperature on Gas Yield.*

[Horizontal Retorts.]

Combustion Chamber Temperature.	Therms per Ton of Coal.
1100° C.	63
1300° C.	68·7
1370° C.	71·5

As regards carbonization in vertical retorts, high heats have a further advantage in that steaming to a greater extent is possible than it is if the working temperature be lower; this being due to the fact that water gas production is an endothermic reaction. The consequence of this upward trend in carbonizing temperatures has been that refractories suitable for use under the old working conditions have proved unsuitable for present-day needs; and it has therefore been necessary to replace, in the hottest zones of the plants, the firebricks and siliceous bricks previously employed by silica bricks containing approximately 95 p.ct. of silica.

The raw materials from which the bricks are made are as follows:

Firebricks.—Fireclay and grog. The grog is used either in the form of broken bricks or after preparation by the burning and subsequent grinding of fireclay.

Siliceous Bricks.—Naturally occurring rocks composed of small crystals of quartz bonded together with an interstitial argillaceous cement. Such rocks contain argillaceous matter ranging from comparatively small amounts to as much as 50 p.ct. When ground and mixed with water, they yield a mass sufficiently plastic to enable bricks having an adequate strength in the dried condition to be moulded.

Silica Bricks.—Quartzite rocks and ganister are the raw materials. These rocks contain very little interstitial cement between the small crystals of quartz; and the cement is generally of a highly siliceous nature. Bricks are generally made from such rocks after addition to the ground rock of approximately 2 p.ct. of lime in the form of milk of lime.

In Table II. typical figures are given for the composition, specific gravity, and porosity of bricks of the types considered.

TABLE II.—*Composition, Specific Gravity, and Porosity of Refractory Bricks.*

—	Firebrick.	Firebrick (Siliceous).	Siliceous Material.	Silica Brick.
SiO_2	58·20	69·76	91·40	94·87
TiO_2	1·90	1·00	0·41	0·26
Al_2O_3	34·88	25·56	5·29	1·57
Fe_2O_3	3·19	1·79	1·25	0·72
MgO	0·51	0·38	0·20	0·19
CaO	0·57	0·60	0·55	2·21
Alkalis	0·71	0·85	1·01	0·31
Ignition loss	0·20	..	..	..
	100·16 p.ct.	99·94 p.ct.	100·11 p.ct.	100·13 p.ct.
Apparent specific gravity	2·00	1·92	1·61	1·67
True specific gravity	2·60	2·56	2·47	2·35
Porosity	23 p.ct.	25 p.ct.	35 p.ct.	29 p.ct.

In connection with the above analyses, it should be noted that bricks for use in the carbonizing industry are classified according to their silica content as follows by the Institution of Gas Engineers.

Firebricks.—Not more than 75 p.ct. of silica in general, though the content may be as high as 80 p.ct. if the remaining requirements of the specification are fulfilled.

Siliceous Material.—Silica content between 80 and 92 p.ct.

Silica Material.—Silica content 92 p.ct. and upwards.

In addition there is a class of product scheduled as retort material. This may fall into any of the above groups, or it may consist of aluminous material, carborundum, or other refractory material, or of mixtures of any of the above constituents. Silica bricks are nowadays, in most types of carbonizing plant, used in the hottest parts of the settings, and siliceous bricks and/or firebricks in the cooler regions and in the producers.

The chief requirements which must be fulfilled by the bricks may be summarized as follows:

Constancy of Volume.—They must have been fired to a sufficiently high temperature during manufacture to ensure that but slight permanent volume changes occur if the bricks are heated to the working temperature. Permanent volume changes refer to an alteration in the volume of the brick cooled to atmospheric temperature after the heating, compared with the volume of the unheated brick, and are to be distinguished from changes due to reversible thermal expansion. The permanent volume changes are designated "after-contraction" and "after-expansion."

Freedom from Spalling Tendency.—They must not be liable to disintegration (spalling) under the influence of the unavoidable temperature fluctuations to which they are subjected while in use.

Refractoriness under Load.—They must not collapse under working loads at the highest temperatures at which they are used. In other words, the under-load refractoriness must be adequate.

Chemical Stability.—They must be able to withstand the attack of fuel ash and of volatile salts liberated during the carbonization of the coal.

Mechanical Strength.—They must be sufficiently tough to ensure that they are not worn away by the abrasive action of the coke during the discharging periods of the retorts.

Thermal Conductivity.—They must have an adequate thermal conductivity.

Shape.—They must have a good shape and texture.

These requirements may be dealt with somewhat more fully.

CONSTANCY OF VOLUME AND FREEDOM FROM SPALLING TENDENCY.

In the case of firebricks, little need be said under these headings. Firebricks tend to contract in use at high temperature due to partial vitrification of the clay contained in them, and recombination of the silica and alumina. Since, to-day, firebricks are used in carbonizing plant only in positions where the temperatures are relatively low, little is to be feared on this account. Firebricks, and especially the more aluminous varieties, are generally good as regards freedom from tendency towards spalling, and are the better in this respect if they have a coarse texture and high porosity, and if a high proportion of grog has been used in their manufacture.

As regards silica bricks, matters are complicated by the various changes which can occur in the crystallographic nature of silica; and a description of the physical properties of silica, and their bearing on the properties of silica bricks, will therefore not be out of place.

PHYSICAL PROPERTIES OF SILICA AND THEIR BEARING ON THE PROPERTIES OF SILICA BRICKS.

Various Forms of Crystalline Silica.—Silica in the crystalline state is polymorphous, and can exist in three distinct mineral forms:

TABLE III.—*Crystal Forms of Silica.*

—	Specific Gravity.
Quartz	2·65
Cristobalite	2·33
Tridymite	2·27

Each of these forms is capable of existing as a separate entity, though under certain temperature conditions only one of the forms may be stable, and the other forms metastable. When matter exists in a metastable condition, an appropriate stimulus will suffice to bring it into a stable condition; thus a brick lying on its face is stable, but when placed on end it is metastable, since a slight push causes the brick to assume the stable position. A brick supported so as to balance on one corner is unstable, and will fall down spontaneously into the stable position. Similarly, in the case of the three mineral forms of silica, a metastable form shows a tendency to revert to the form stable at the temperature prevailing, though if this temperature be low enough, the speed of reversion may be so slow that geological periods of time are required for any measurable change to be recognizable. Crystalline silica found in nature is almost invariably in the form of quartz.

Quartz is stable at all temperatures below 870° C., at which temperature it enters the metastable region, and then slowly commences conversion into tridymite, the velocity increasing

as the temperature rises, until the change—at first infinitesimally slow—finally takes place rapidly enough to reach completion in a period of hours at temperatures above 1400° C., but below 1470° C. This is probably only the case in the presence of a flux, such as sodium tungstate.

Once conversion into tridymite has occurred, the new form preserves its identity even though the temperature be lowered. Naturally, no change in the sense of reversion to quartz would be expected to occur above 870° C., since between this temperature and 1470° C. tridymite is the stable form. Below 870° C., however, tridymite is metastable, and quartz is stable, though when the temperature is allowed to fall below this value the tendency towards reversion to quartz becomes progressively smaller and smaller. Hence, once tridymite has been formed, it may be preserved unchanged when the mass is cooled down to ordinary temperatures, even though cooling has been slow. If quartz be heated to 1250° C. in absence of a flux, cristobalite formation commences, and proceeds with gradually increasing velocity at still higher temperatures. At temperatures above 1470° C., according to some authorities, or at still higher temperatures according to other observers, cristobalite is the stable form and tridymite is metastable. Between 1470° C. and 1250° C. cristobalite is metastable, and between 1250° C. and 870° C. quartz is metastable, since, as has been stated above, tridymite is the only form stable throughout the range 870° to 1470° C. Nevertheless, the reverse change from cristobalite to tridymite takes place so slowly at temperatures below 1250° C. that it may for all practical purposes be neglected; and once cristobalite has been formed, it persists when the temperature is allowed to fall. At temperatures above 1470° C., tridymite is converted into cristobalite. The change from quartz to cristobalite may occur directly or with tridymite formation as an intermediate stage, depending on the temperature and on the absence or presence of an active flux or catalyst. Under suitable conditions, a mass of quartzose material may show both conversions simultaneously, portions of the material passing to cristobalite and portions to tridymite.

The melting-point of tridymite is 1670° C., but if the substance be heated to this temperature sufficiently slowly for cristobalite to be formed, no fusion occurs until a temperature of 1710° C.—the melting-point of cristobalite—is reached. This phenomenon is possible since at temperatures above 1600° C. the speed of conversion of tridymite into cristobalite is comparatively rapid.

It will be evident from the specific gravity figures which have been quoted that large expansion changes occur when one mineral form of silica changes into another. The approximate values of these volume changes are shown in Table IV.

TABLE IV.—*Volume Alterations Associated with Conversion of One Form of Crystalline Silica into Another.*

Change.	P.Ct. Increase in Volume.
Quartz to cristobalite	14
Quartz to tridymite	17
Cristobalite to tridymite	2·6

In addition to the three mineral forms of silica, further crystallographic varieties are known, since each form possesses the property of existing in two modifications, save tridymite, which can exist in three modifications. The modifications are, for convenience, distinguished from each other by the use of the prefix "alpha" or "beta," coupled with the name of the appropriate form. The alpha and beta modifications of any one mineral form of silica may be converted instantaneously, or almost instantaneously, the one into the other as often as is desired, merely by varying the temperature above or below a transition temperature or range of temperature. There is thus a fundamental difference between the alpha and beta modifications and the mineral forms, since, as has been explained, the change from one mineral form to another is, to all intents, a uni-directional and irreversible one, and, furthermore, requires a considerable, or, at any rate, a relatively prolonged, time. Nevertheless, just as in the case of these changes, there are volume changes associated with the alpha-beta changes.

Table V. (representing observations by Fenner, McDowell and Endell, and Rieke) shows the transition temperatures and volume changes for the various modifications.

TABLE V.—*Reversible Inversions of Silica.*

[According to Fenner, McDowell and Endell, and Rieke.]

Change.	Inversion Temperature.	Increase in Volume.	Speed of Inversion.
α Tridymite to β tridymite	117° C.	0·5 p.ct.	Very rapid
β_1 Tridymite to β_2 tridymite	163° C.	small	,, ,,
α Cristobalite to β cristobalite*	245° C.	3·5 p.ct.	Instantaneous
α Quartz to β quartz	575° C.	1·3 ,,	,,

* The inversion to the β form occurs at temperatures between 219·7° and 274·6° C. and the reverse change at temperatures between 198·1° and 240·5° C.

The reverse changes occur at temperatures substantially the same as those recorded, though in the case of cristobalite, for which the transition is not so sharp, the reverse change occurs at a temperature appreciably lower than does the forward change—namely, at 198·1° to 240·5° C. The precise temperature at which a particular specimen of cristobalite manifests the alpha-beta change depends on its previous history. The alpha-beta changes take place instantaneously in the case of cristobalite and quartz, but not quite so quickly in the case of tridymite; and the changes are therefore so rapid that it is impossible to preserve the beta forms at ordinary temperatures, even by quenching.

SIGNIFICANCE OF THE ABOVE PROPERTIES OF SILICA IN CONNECTION WITH THE MANUFACTURE AND USE OF SILICA BRICKS.

The volume changes associated with the seven modifications of crystalline silica are of great importance in connection with the manufacture and use of silica bricks. In the first place, kiln firing must be sufficiently prolonged and intensive to ensure that the specific gravity of the finished bricks shall be low, indicating relative freedom from unconverted quartz. Table VI. indicated *approximately* the relationship between specific gravity and content of unconverted quartz.

TABLE VI.—*Silica Bricks. Approximate Relationship between Specific Gravity and Content of Unconverted Quartz.*

Specific Gravity.	Content of Unconverted Quartz.
2·33	Trace
2·34	3·1 p.ct.
2·35	6·2 ,,
2·36	9·3 ,,
2·37	12·5 ,,
2·38	15·6 ,,
2·39	18·7 ,,
2·40	21·8 ,,
2·41	25·0 ,,
2·42	28·1 ,,
2·43	31·2 ,,
2·44	34·3 ,,
2·45	37·5 ,,
2·49	50·0 ,,

Not only will bricks of high specific gravity give rise to slow but considerable volume changes in a setting during use, but the individual varying expansions of bricks in juxtaposition will set up strains and open up cracks in so haphazard a manner that no suitable allowance in design can be made to obviate the difficulties. It is, therefore, essential for the well-being of the plant to make use of bricks with a specific gravity as low as is commercially possible, and it is highly desirable that no bricks with a specific gravity in excess of 2·36 be employed. Even at this value, as much as 9·3 p.ct. of unconverted quartz would be present; and were it possible to secure general acceptance of a still lower specific gravity as the criterion for the rejection of a brick, it would be all to the good.

The above figures refer to bricks manufactured from one particular type of rock. In the case of some rocks, the specific gravity for a predetermined content of unconverted quartz is lower than the value tabulated; and in such cases it becomes necessary to fix 2·34 as the highest desirable specific gravity. Within recent years the kiln firing of silica bricks has been much improved, and several manufacturers are able to supply products showing consistently very good conversion of the quartz.

The relationship between specific gravity and after-expansion of silica bricks at 1500° C. is shown in Table VII.

TABLE VII.—*Effect of Specific Gravity on the After-Expansion of Silica Bricks at* 1500° C.

Specific Gravity Range.	Mean After-Expansion (2 Hours at 1500° C.).
2·32 to 2·35	0·65 p.ct. linear
2·36 ,, 2·38	1·31 ,, ,,
2·39 ,, 2·41	1·63 ,, ,,
2·42 ,, 2·44	1·80 ,, ,,
2·45 ,, 2·48	2·62 ,, ,,

Here again the data refer to one type of brick. Depending on the nature of the rock used, the expansion figures may be higher for a definite specific gravity.

The fact that silica bricks consist of a mixture of three distinct mineral forms of silica, each of which can exist in alpha and beta modifications, coupled with the fact that inversions of the modifications are associated with sudden volume changes, renders the bricks peculiarly liable to spalling. The large disruptive forces at work during such inversions may readily be pictured if the figures of Table VIII. are considered.

TABLE VIII.—*Expansion of Quartz over the Range* 400° *to* 1000° *C.*

Temperature Range.	P.Ct. Expansion by Volume.	Nature of Expansion.
400° to 575° C.	1·2	Gradual
At 575° C.	1·3	Sudden
575° to 1000° C.	−0·2	Gradual

It is evident that the sudden increase in volume due to the thermally reversible change from alpha to beta quartz at 575° C. is greater than the whole of the expansion between 400° and 575° C., and is several times as large as the contraction which occurs between 575° and 1000° C. Though the porosity of the bricks will accommodate part of the sudden expansion at 575° C., it is evident that extreme caution must be exercised whenever quartz bricks are subjected to fluctuations about the inversion temperature. In the case of badly burned silica bricks containing (say) 25 p.ct. of unconverted quartz, the volume changes at 575° C. will, of course, not be as large as they would be in the case of bricks composed wholly of unconverted quartz, but they will nevertheless be sufficiently great to cause spalling if the temperature fluctuations are sufficiently sudden. The disruptive effect which the inversion change can exert on a brick is comparable with the huge forces developed during the freezing of water in a confined space; these forces, as is well-known, being sufficient to burst the strongest pipes.

Of even greater magnitude are the forces developed during the alpha-beta cristobalite change at temperatures in the neighbourhood of 225° C., since the corresponding volume change is, in this case, as high as 3·5 p.ct. Silica bricks containing much cristobalite must therefore not be subjected to frequent temperature changes in this temperature region, otherwise severe spalling troubles develop.

In the case of tridymite, the volume changes associated with the alpha-beta inversion are much smaller than they are for the other mineral forms, but, even so, fluctuations of temperature at 117° and 163° C. must be avoided.

From the foregoing, it is clear that silica bricks intended for use at high temperatures should contain as little unconverted quartz and as much tridymite as is commercially possible. Comparative freedom from quartz not only conduces to stability of the settings, since permanent volume changes due to progressive completion of quartz conversion at high temperatures will be minimized, but it also enables periodical fluctuations over the temperature critical for alpha-beta quartz inversion to be attended with much less danger. Nevertheless, even with a setting built up of bricks with an originally high specific gravity, after long working at high temperatures variations in temperature on either side of 575° C. will no longer be dangerous, since by that time the bricks will for the most part not contain much unconverted quartz.

The presence of a large content of cristobalite in silica bricks is not necessarily dangerous, since, in most cases, it is possible to secure that no part of the setting shall ever cool below 250° C.; and on occasions when complete cooling down is essential from some cause or another, arrangements can always be made so that cooling over the critical range is slow; similar precautions being, of course, taken when the setting is again put into use.

The essential points about the use of silica bricks may be summarized as follows:

1. Strict insistence on the supply of bricks of low specific gravity, to avoid the development of strains and permanent expansion at working temperatures.
2. Slow heating-up when the setting is put into use, so that the inversion points may be passed in safety.
3. Maintenance of the temperature above 600° C. at all times, so that volume changes due to inversions are avoided, and spalling thereby prevented.
4. Slow cooling-down when it becomes necessary to shut down a setting.

CONTROL OF THE MANUFACTURING PROCESS.

Dale has recently published the results of an investigation of peculiar importance in connection with the manufacture of silica bricks, under the title "The Control of Silica Brick Making based on Load Test Indications," in Bulletin 11 of the British Refractories Research Association (March, 1926). The same bulletin contains a further useful paper by Green and Edwards on the "Spalling of Silica Refractory Material at Low Temperatures"—a subject treated also by Green and Dale in Bulletin 12 (April, 1926).

As regards manufacture, the sequence and nature of the changes occurring during the firing of lime-bonded silica bricks are first discussed, and the mechanism of the formation of cristobalite and of tridymite is described. The next section deals with the control of the larger grades—grog fractions—and emphasizes the importance, where bricks are manufactured from a blend of rocks, of using the more readily convertible rocks for the grog, and the more difficultly convertible rocks for the matrix—which latter is, of course, developed from the portion of the mixture below ¼ mm. in diameter, and ranging from that size to impalpable powder. The reason for this is the fact that particle size plays an important rôle in speed of conversion; and since surface, too, is effective, crushing should be carried out in such a manner as to secure a maximum of angularity in the fragments. Wet grinding is therefore to be avoided, and the grog should be made from the rocks which on grinding give the most angular products.

As regards the influence of kiln firing temperature on the rate of conversion of the grog, it is stated that the mutual relationship between the two is as shown in Table IX.

TABLE IX.—*Effect of Temperature on Speed of Conversion of Quartz.*

Temperature.	Speed of Conversion (Value at 1250° C. taken as Unity).
1250° C.	1
1450° C.	6
1550° C.	26

Thus, as much conversion can be effected in an hour at 1550° C. as would require a day at a temperature of 1250° C.

It is therefore suggested in the article that, as soon as the temperature during kiln firing has passed 575° C., the temperature should be raised as quickly as possible to the highest attainable temperature, and the bricks should be allowed to soak at this temperature for a short period of hours. Finally, the kiln should be allowed to cool somewhat to the optimum soaking temperature required to develop an elastic matrix, since the elastic property of the matrix is a factor which influences spalling. It is also suggested that pre-fired material might with great advantage be used for the grog fractions; and it is pointed out that the schedule laid down need not involve any serious increase in fuel consumption. A significant statement reads as follows: "In fact, with a suitable matrix, the firing might conceivably be reduced to a simple continuous tunnel oven process with the need for no higher temperatures than those required for the firing of certain types of firebrick and pottery."

Tridymite formation is ascribed to the solution of cristobalite in the matrix with formation of a saturated silicate glass followed by devitrification of the mass and deposition of tridymite. As regards the grog fraction, complete conversion into tridymite requires very prolonged soaking; and an "all tridymite" brick is so far not a commercial proposition. This is particularly the case when the quartzite rock is exceptionally pure.

In connection with this, Hugill and Rees (Trans. Ceram. Soc. **27**, 97, 1927-28) have recently shown that silica bricks can be made without added bond, and that, under similar conditions as to kiln firing, the degree of quartz conversion is higher than it is when lime is used as a bond. However, when no bond is present, the conversion is almost entirely to cristobalite, whereas, in presence of a bonding agent, much tridymite is formed. Bricks made without bond are, of course, not as strong as those made with a bond. The same investigators (Bulletin of the British Refractories Research Association, **15**, 1, 1927) have also shown that silica bricks having an exceptionally good resistance to spalling and of low specific gravity may be made by using 3½ p.ct. of deflocculated ball clay as bond, instead of 2 p.ct. of lime. The bricks convert as readily during burning as do the lime bonded variety.

REFRACTORINESS UNDER LOAD.

This is much more significant than is refractoriness as measured without load, since the influence of pressure is, as indicated below, sometimes very marked.

The ordinary test for refractoriness is carried out by heating a pyramidal test-piece of the material surrounded by Seger Cones. After a temperature of 1000° C. is attained, further rise of temperature is effected at the rate of approximately 50° C. per five minutes. Towards the end of the test it is advisable to increase the temperature somewhat more slowly. The test may be carried out either by heating the test-piece until a specified Seger Cone falls (Gas Engineers' Refractoriness Safety Test) or by heating the test piece until it becomes well bent (Refractoriness Squatting Test). The cone chosen for the former test is such that a high-class brick should show no signs of fusion at the temperature corresponding with the softening temperature of the specified cone.

The behaviour of such bricks is shown in Table X.

TABLE X.—*Refractoriness of Gas Works Refractories.*

—	Gas Engineers' Refractoriness Safety Test. No Signs of Fusion at	Refractoriness Squatting Test. Test-Piece Well Bent at
Firebrick	Cone 29 = 1650° C.	Cone 32 = 1710° C.
Siliceous material	Cone 29 = 1650° C.	Cone 31 = 1690° C.
Silica brick	Cone 30 = 1670° C.	Cone 33 = 1730° C.

"Retort material" must not show signs of fusion at Cone 28 (1630° C.) in the refractoriness safety test.

It will be evident that the refractoriness test does not reveal any very appreciable difference between good-class bricks of these three types. Matters are, however, very different when tests are carried out under load; and results would be approximately as in Table XI.

TABLE XI.—*Refractories Under a Load of 25 Lbs. per Sq. In.*

—	Temperature of Initial Collapse.	Temperature of Complete Failure.
Firebrick	1350° C.	1450° C.
Siliceous material	1380° C.	1450° C.
Silica brick	1650° C.	1650° C.

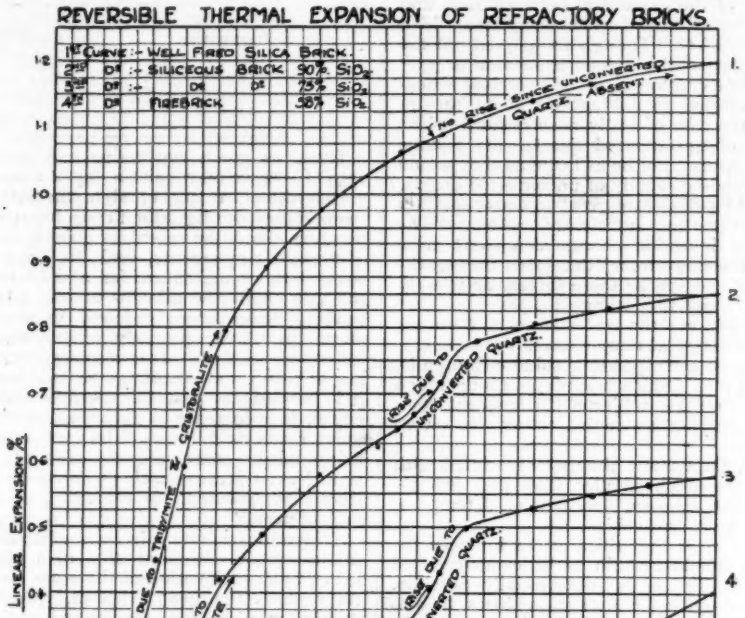

REVERSIBLE THERMAL EXPANSION OF REFRACTORY BRICKS.
1st CURVE :- WELL FIRED SILICA BRICK.
2nd " :- SILICEOUS BRICK. 90% SiO2
3rd " :- " " " 75% SiO2
4th " :- FIREBRICK " 38% SiO2
LINEAR EXPANSION %
TEMPERATURES °C
RAPID EXPANSION DUE TO TRIDYMITE & CRISTOBALITE
RAPID EXPANSION DUE TO TRIDYMITE & CRISTOBALITE
RISE DUE TO UNCONVERTED QUARTZ.
RISE DUE TO UNCONVERTED QUARTZ.
NO RISE - SINCE UNCONVERTED QUARTZ ABSENT

Table XI. (p. 731) indicates some very large differences in the behaviour of the 95 p.ct. silica bricks and the others. Actually, however, the differences are still greater, since gradual collapse of firebricks and siliceous bricks will occur at lower temperatures than those indicated if heating be prolonged even at quite small loads (4 lbs. per sq. in.), whereas silica bricks can be maintained for an almost indefinite period at a temperature just short of the temperature of collapse. The differences are due to the fact that firebricks and siliceous bricks have a long vitrification range, and for temperatures within this range the matrix of the brick is in the condition of a highly viscous, somewhat plastic, mass. In the case of silica bricks, the viscosity is very much higher, and no question of viscous flow arises until the temperature of failure is reached. Moreover, the amount of matrix is much less. With firebricks and siliceous bricks, collapse is manifested by a squatting of the test-piece, associated with bulging; and squatting is accelerated as the temperature is raised above the point of initial subsidence. In the case of silica bricks, ultimate failure is attended with a shearing of the test-piece such as occurs with cast metals.

The above considerations serve to explain why it is possible to employ silica bricks at temperatures considerably higher than can be safely employed with bricks of the other two types.

Chemical Stability.

Increased resistance to chemical attack is obtainable by the use of bricks of uniform, fine texture and low porosity. These desiderata are just the reverse of those required if a maximum resistance to spalling is desired and some compromise is therefore necessary. Silica bricks have proved themselves to be immune against attack by alkaline chlorides and volatile iron compounds liberated during the carbonization of many coals, whereas firebricks and siliceous bricks are attacked and become crazed at the surface. There is then a tendency for the surface layers to spall, due to the difference between the coefficient of thermal expansion of the affected portion of the brick and the remainder of the brick.

Mechanical Strength.

Adequate mechanical strength is secured by the proper grading of the raw materials and by the use of the right proportion of bonding material. Each raw material requires special treatment with this end in view; and the various manufacturers of bricks have, as a result of experience, in most cases worked out the most suitable grading for their particular materials from the point of view of obtaining the best results. Adequate kiln firing is also necessary in order that good mechanical strength may be obtained; and under-fired goods are in many cases unsuitable for use owing to their friable nature.

Thermal Conductivity.

Thermal conductivity, though important, has not as high a significance as one would expect, since the limiting factor in heat transmission is the low conductivity of the coal. Table XII., based on the work of Green (Bulletins 10 and 12 of the British Refractories Research Association), shows the thermal conductivity and diffusivity of various types of bricks.

The relationship between conductivity (K) and diffusivity (k) is such that $K = kcs$ where c = specific heat and s = apparent specific gravity.

Diffusivity (in C.G.S. units) is the rise in temperature produced in one cubic centimetre by one calorie in one second through one square centimetre of a layer one centimetre thick, and having a temperature difference of one degree Centigrade between its faces.

Table XII.—*Thermal Conductivity and Diffusivity of Refractory Bricks.*

[Values in C.G.S. Units.]

Temperature. °C.	Thermal Conductivity.			Thermal Diffusivity.		
	Silica.	Fire-brick.	Semi-Silica (81 P.Ct. SiO_2).	Silica.	Fire-brick.	Semi-Silica (81 P.Ct. Silica).
600	0·00155	0·00140	0·00135	0·00355	0·00250	0·00270
700	0·00165	0·00145	0·00145	0·00365	0·00255	0·00285
800	0·00175	0·00155	0·00160	0·00380	0·00265	0·00305
900	0·00190	0·00165	0·00175	0·00395	0·00275	0·00325
1000	0·00205	0·00175	0·00195	0·00415	0·00285	0·00350
1100	0·00225	0·00185	0·00215	0·00435	0·00300	0·00380
1200	0·00245	0·00200	0·00235	0·00465	0·00320	0·00410
1300	0·00270	0·00225	0·00265	0·00495	0·00345	0·00440

Due to their much lower apparent specific gravity, silica bricks,

though but slightly superior to firebricks as regards thermal conductivity, have a higher heat diffusivity than have firebricks. To this fact, as well as to the fact that working temperatures can be very much higher when silica bricks are used, is due the considerable reduction (33⅓ to 50 p.ct.) in the carbonizing time which has been rendered possible by the introduction of silica bricks in the carbonizing industry. Cassan (La Céramique, 31, 1928, 249) has made the interesting suggestion that the conductivity of bricks is increased during use in the retorts by the deposition of carbon in the pores of the bricks through cracking of hydrocarbons. Carbon, as is well known, has in the form of graphite a thermal conductivity much greater than that of firebricks. It would then appear possible for the superior conductivity of silica bricks compared with firebricks to be still further enhanced under working conditions, since, due to their higher porosity, there would be a higher proportion of deposited carbon in such bricks than there would be in the case of firebricks.

SHAPE AND TEXTURE.

The surfaces of the bricks should be true, and deviations from the specified dimensions must be small, for otherwise it would be impracticable to secure thin joints. Bricks are used in the form of squares (*e.g.*, 9 in. by 4½ in. by 3 in.) and "specials." The latter are used in a very wide variety of shapes, and are generally provided with tongues and grooves which assist in securing a rigid structure and tight joints.

REVERSIBLE EXPANSION.

The need for bricks having a low after-expansion or contraction has already been emphasized. The reversible thermal expansion of refractory bricks varies very widely with the nature of the brick and its heat treatment during manufacture; and provision must therefore be made in the design of the settings for expansion cavities which enable the reversible expansion to be accommodated. The reversible thermal expansion of typical gas-works refractories is shown in the graph, which embodies data secured for us by Prof. J. W. Cobb. The high expansion of silica and highly siliceous bricks at low temperatures, due to the presence of cristobalite and tridymite, is very noticeable, as is also the abrupt expansion shown at 575° C. by bricks containing appreciable amounts of unconverted quartz. In the case of firebricks, the thermal expansion is very nearly a linear function of the temperature for the whole range shown.

JOINTING CEMENTS.

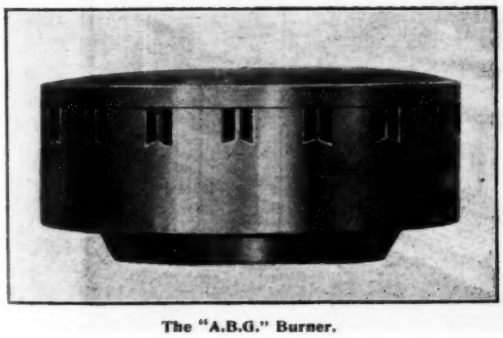
A jointing cement must have a composition and texture dependent on the nature of the bricks with which it is to be used, the temperature to which it will be subjected, and the nature of the corrosive agents which may come into contact with it. Plasticity should be as high as possible, provided that it is not secured at the expense of refractoriness or chemical stability. The chief function of a jointing cement is to fill the spaces between the bricks, and a plastic cement enables this to be effected in a satisfactory manner, and at the same time facilitates the obtaining of thin joints. An important subsidiary function of a jointing cement is the holding together of the structure. Refractory jointing cements as used in the gas industry are, in general, not self-hardening, and mature only under the influence of heat.

Plasticity is obtainable by the use of mixtures containing much fireclay or ball clay, and by fine grinding; but cements with a high content of clay, while suitable for firebrick, are not adapted for use with silica bricks employed at relatively high temperatures, since slagging action between the combined calcium of the bricks, the silicates of the clay, and volatile salts derived from the coal, is likely to occur, with consequent development of leaks, which may have serious results. The extent to which grinding can safely be carried out depends on the composition of the cement. In some cases, grinding beyond a certain fineness has a very harmful effect on refractoriness, while in other cases—*e.g.*, in the case of a mixture of lime and silica rock—an extreme state of subdivision is without danger. Depending on the nature of the cement, it may be useful to have present a certain proportion of relatively coarse material of grain size between $\frac{1}{25}$ in. and $\frac{1}{10}$ in. The composition of the finest fractions is of great importance, and care should be taken that it does not lie in such a position in the alumina-silica equilibrium diagram that vitrification of the matrix and interaction between this and the coarser fractions can give rise to the eutectic of alumina and silica containing 10 to 13 p.ct. of alumina. In view of the necessity of employing for silica bricks cements containing mineral proportions of clay or other aluminous compounds, such cements are rather short in working, and it is often advantageous to damp the bricks before the cement is applied. With such cements it is, however, necessary to secure that some reactive ingredient is present which will cause the cement to mature at or below working temperatures, otherwise the cement will be liable to be worn away by the abrasive forces to which it is subjected.

A HOTPLATE BURNER OF NOVEL DESIGN.

The "A.B.G." Burner.

The accompanying illustration is of a new hotplate burner recently introduced into this country. Of unusual design, and embodying several interesting features, this burner—which, made



The "A.B.G." Burner.

by Messrs. J. W. Bakhuizen, The Hague, Holland, is marketed under the title "A.B.G."—has, we understand, already enjoyed considerable popularity in Holland, and is also attracting much attention in other countries. Briefly, four main claims are made for it: First of all, it is highly efficient thermally (65 p.ct. is the figure); secondly, lighting-back is eliminated; thirdly, liability to corrosion is at a minimum; and finally, the simplicity of design renders cleaning exceedingly easy.

There is nothing flimsy about the construction of the burner or of the accessory tap. The latter is made for long service, and is adjusted so that the flame in the burner proper is at full or at a simmering consumption. Of course, the consumer is able to regulate the consumption between these points. Of particular interest is the fact that the needle valve is fixed; the necessary adjustment being obtained by turning a perforated nut positioned in front of the needle.

Coming to the burner proper, the first thing of note is that the primary air opening is non-adjustable. Gas issues from the burner tube through six holes of comparatively large diameter, and strikes the underside of a hemispherical cover which fits over the burner. Thoroughly mixed and under constant pressure, the gas then passes through thirty-four rectangular openings, arranged in pairs, in the side of the burner cup. Some of these openings can be clearly discerned in the photograph. Seventeen flames of equal length and intensity are thereby formed; their direction being carefully allowed for in the design. The burner itself is made of brass.

The agents for this country are Messrs. F. G. Lawrence & Co., 13, Crutched Friars, E.C. 2.

The Colliery Manager's Pocket Book, 1929.—The Sixtieth Edition of the "Colliery Manager's Pocket Book," which, edited by J. Vincent Elsden, D.Sc., and Hubert Greenwell, F.S.S., is published by the Colliery Guardian Company, Ltd., has just been issued. This volume maintains the high standard of the previous ones, and is an invaluable aid to all who are in any way responsible for the efficient working of colliery plant and processes. The information is extensive, and accurate throughout.

South Metropolitan "Co-Partnership Journal."—The December issue of the "Co-Partnership Journal" of the South Metropolitan Gas Company marks the completion of the twenty-fifth annual volume; and we take the opportunity of offering our congratulations to the Editor, Mr. W. T. Layton, on the sustained success of the Company's monthly magazine. In the words of the Editor, "the experiment of 1903-4 has been successful, and our little monthly has for long years had a recognized place as one of the pioneer works magazines and house organs."

GAS APPLIANCE DISPLAYS AT THE COOKERY AND FOOD EXHIBITION.

ON another page of this issue is published a view of the Gas Light and Coke Company's display at the Cookery and Food Exhibition held recently at Olympia, West Kensington. Reproduced here are two photographs of the stand of Radiation, Ltd., at that exhibition. The firm had an extensive and comprehensive display of hotel and restaurant gas-fired appliances. Their stand was exceptionally attractive, and created a great deal of attention, not only because of the scientific, economic, and practical advantages of the apparatus on show, but because of their splendid appearance Practically all the appliances were "Rado" enamelled in mottled finish ; and the general effect of cleanliness was most striking. The exhibiting firms were Arden Hill & Co., the Davis Gas Stove Company, Ltd., Fletcher, Russell, & Co., the Richmond Gas Stove Company, Wilsons & Mathiesons, Ltd., and John Wright & Co. The Eagle Range and Grate Company had a separate stand.

Safety in Mines Research Board.

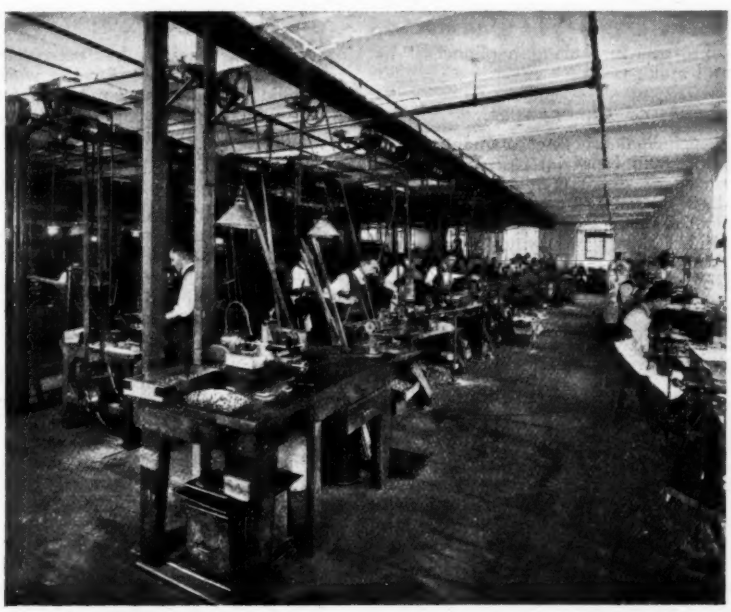
In order to obtain definite knowledge of the conditions that are most unfavourable to either the ignition of coal dust or the propagation of coal-dust explosions, the Safety in Mines Research Board undertook laboratory and large-scale researches in each of these problems. Large-scale experiments carried out at Eskmeals during the years 1923-25, using a steel gallery 18 in. in diameter, were described in a previous paper ("S.M.R.B." Paper No. 33, "The Inflammation of Coal Dusts: The Effect of the Chemical Composition of the Dust," by T. N. Mason and R. V. Wheeler). The results showed that a rough relationship exists between the content of volatile matter in a coal and the inflammability of its dust. Most of the coal dusts tested in the 38-in. gallery were tested during the same period in a steel gallery 7½ ft. in diameter; and the results of these tests are described in a supplementary paper just published by the same authors, entitled "The Relative Inflammability and Explosibility of Coal Dusts" ("S.M.R.B." Paper No. 48, H.M. Stationery Office; price 3d.). The tests made in the larger tube showed that the inflammability of a coal dust as measured by the mean speed of flame, and its explosibility as measured by the maximum pressure developed—both over a given distance—are approximately of the same order, and that this order is in close agreement with the relative proportion of incombustible matter required to be mixed with the coal dust in order to suppress its inflammability. The tests also confirm the value of volatile matter determination as a guide to the degree of inflammability of a coal dust.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the Ranelagh Meter Works of Messrs. George Glover & Co.

On Dec. 5, members of the Association, accompanied by the President, Mr. W. T. Kenshole, of the Lea Bridge Gas Company, visited the Ranelagh Meter Works of Messrs. George Glover & Co., at Chelsea. On arrival, the visitors were received by Mr. Albert Glover (General Manager).

Mr. GLOVER, in welcoming the members of the Association to the works, referred to their previous visits in 1907, 1914, 1920, and 1924. It was therefore evident that these visits were profitable and helpful. He remembered that Mr. Chandler came there as their President in 1920; and he had been very pleased to note his appointment as Distribution Superintendent at Tottenham. Since their visit in 1924, the high-capacity meter had come to the front, owing to the pioneer work of Mr. Holt, of the Gas Light and Coke Company. Their experimental work in this direction had been delayed by the fire last year, but now they had a high-capacity meter, second, they believed, to none. One of the risks in connection with the high-capacity meter was that it might in time get overloaded. Everyone was accustomed to taking the badged capacity of the "lights" type, or even of a Standard meter, and saying that it would pass much more than that amount; but it must be realized that the badged capacity of the high-capacity meter was its capacity; and the meter should not be asked to work at still higher rates. His favourite was still the Standard meter, the capacity of which was very carefully worked out on its introduction in 1921 by the Life of Gas Meters Committee. They had to make and stock the three types of meter, as a number of their customers still preferred the "lights" type. The fire last year enabled them to renew the front portion of their works. This portion, which was burnt out, consisted of two floors at different levels from the three floors in the back portion. They had now been able to bring the floors on the front portion to the same level as the back, and so make the building more homogeneous and convenient.



PART OF THE "AUTOMATIC" SHOP.

GEORGE GLOVER'S RANELAGH WORKS.

The recent re-building of George Glover's Ranelagh Meter Works at Chelsea marks another stage in the history of this Company, which, for over 67 years, has continued to progress and maintain its position in the front rank of British gas meter manufacturers.

The Sales of Gas Act, 1859, first gave a definition of the cubic foot—the official standard of measure to be used in the sale of gas. A cylindrical copper vessel with conical ends, known as the cubic foot bottle, was constructed to comply with this definition and was deposited in the Standards Department at Whitehall. This instrument, however, could not be generally used for the purpose of testing consumers' gas meters, and in 1860 it was found necessary to pass an amended Act making the 1859 Act permissive, and postponing its operation for a further twelve months.

At this point Dr. George Glover (the founder of the Company) was entrusted with the duty of preparing the proper instruments for carrying the Act into operation. Dr. Glover devised a "direct transferrer," so that the gaseous contents of the cubic foot bottle could be transferred without error to any other container, and be used for the graduation of the test "gasometers."

"A PROUD INHERITANCE."

He also designed and applied for a patent for test gasometers with containers made of a special anti-corrosive metal. These were constructed in sets of three, under Dr. Glover's personal supervision, and were officially reported upon by the then Astronomer Royal as being "as perfect as human skill could make them." One set was deposited with the Standards Department, Whitehall, and duplicates with the Chief Magistrates of London, Edinburgh, and Dublin, after which the Sales of Gas Act came into operation.

It is interesting to note that Dr. Glover had a duplicate of one of the test gasometers made for his own use; and this instrument may still be seen in the Proving Department of George Glover & Co., Ltd., Ranelagh Works, Chelsea. It is still, after an interval of nearly seventy years, in a state of complete preservation.

In 1861, Dr. Glover, assisted by his nephew, Mr. J. William Glover, started a small gas meter factory in Westminster, and this was the foundation of the present Company. More commodious premises were subsequently found in Ranelagh Road, Pimlico, and these, in turn, were out-grown by the steady development of the business. Dr. Glover procured still larger premises at Chelsea, where he continued his personal supervision up to the time of his death in 1899, at the age of 95.

In 1901, a further extension to the works was necessitated at Chelsea, which are now under the direction of Mr. Albert Glover—thus carrying on the family tradition of personal oversight of the manufacture of the George Glover meter. The introduction in 1887 of the prepayment meter revolutionized gas meter production; and the George Glover "slot" meters sent out since that date have played no small part in popularizing gas for domestic use.

In 1920, the now familiar "Ranelagh" price-changer meter was introduced; and it is of interest to note that this was the first gas meter to have the whole of the prepayment attachment—*i.e.*, coin slot, price-changing disc, money box, handle, padlock, and scale—accessible from the front.

In May, 1927, the Ranelagh Works were partially destroyed by fire, and the new works, now completed and brought into full productive capacity, will enable the firm still more effectively to carry on the traditions, handed down to them by the

THE REPAIR SHOP AT THE RANELAGH WORKS.

original founder, of providing gas measuring appliances " as perfect as human skill could make them."

PRINCIPAL PROCESSES OF MANUFACTURE.

A brief description of the principal processes of manufacture carried out in the new factory will be of interest. The work involved covers a wide range of dry gas meters, including " lights " type up to 3000-lights, Standard meters up to No. 12, the " Ranelagh " prepayment meter, gas fire meters for hotels, high-capacity meters—ordinary and prepayment—and test meters.

The manufacture commences with the stamping shop, where the steel plates (heavily coated with pure tin to resist corrosive action) which constitute the casing of the meters are formed and folded or pressed into shape. Rows of heavy, power-driven presses are kept busily at work turning out sides, fronts, tops, bottoms, partitions, &c.

In the adjacent foundry all the anti-corrosive white metal parts such as valves, gratings, &c., are cast and sent forward to be hand-ground in pairs to ensure smooth working.

The " automatic " shop is of special interest. In this department the various component parts of the automatic slot attachment are made and assembled. This work has to be performed carefully. The mechanism must be easy and smooth to operate, but without any loose-fitting or tight parts. Each component must engage with absolute precision, and be turned out to a standard gauge.

The assembling shop draws its supplies from a new spacious general store. The tinsmiths make the meter cases; and these are then sent to the leather shop, where the leather diaphragms are prepared and fitted. The leather is prepared from Persian sheepskins which, when correctly dressed, have been found from long experience to be the most durable substance from which to make the " lungs " of the meter. The diaphragms having been fitted, the meters are returned to the assembling shop, where the finishers put in the valves, indices, and automatic mechanism.

The meters are now transferred to the proving and testing shop. Here every meter is subjected to rigid inspection and test prior to being returned again to the tinsmiths to have the top soldered on.

Tests are carried out at pressures in accordance with the latest Board of Trade regulations, as well as at higher pressures—namely, 12 in. for soundness, and 3 in. for registration with the outlet fully open—so as to ensure correct registration at varying rates of consumption and pressures of gas, and to prevent " slow " registration even if the meter is overworked.

At this stage all meters are sent to the Gas Meter Testing Station of the London County Council, for official inspection and sealing. When they are returned, they are transferred to the paint shop, where the familiar red coat is imparted by means of spraying machines. The meters now emerge spick-and-span with every internal part made with engineering precision, tested, and proved correct in every respect.

Another important department at George Glover's Ranelagh Works is the repair shop, to which all sizes of meters which have been in commission for many years are sent to be given a new lease of life.

Everything possible has been done in the reconstruction to improve the conditions for the workers, and a large canteen is provided where the employees may purchase cheaply good meals which are prepared for them, or warm the food they have brought from home.

The main building, originally of two stories, has been reconstructed with three floors, bringing the levels into harmony with those of the machine shop departments, which latter were fortunately untouched by the fire.

Every consideration has been given to the questions of lighting, ventilation, and inter-departmental communication, resulting in an efficient and up-to-date lay-out which will facilitate the progression and control of work, and be capable of dealing with a much increased production.

At the conclusion of the visit the members were entertained at tea, and were joined by Mr. H. M. Thornton, Chairman of the Company, with whom were Mr. J. H. Bingham, Works Manager, Mr. A. G. Flood, and Mr. S. Clark.

Mr. KENSHOLE remarked that they had had the privilege that afternoon of visiting the most modern meter manufactory in the country. The high-capacity meter, of which they had made a thorough examination, was very useful in these days when taller buildings were being erected, with higher consumptions and limited space for fixing the meters. Meter makers were very much to be congratulated upon having produced such a meter to pass the same amount of gas.

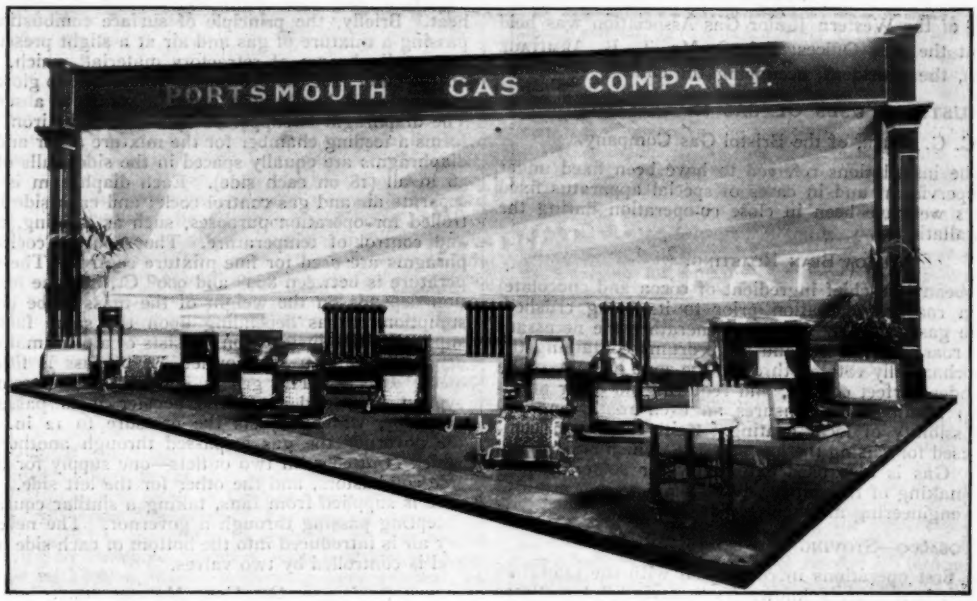
Mr. J. C. WATERS (Croydon Gas Company) moved a hearty vote of thanks to the Chairman and Directors of the Company for the privilege of inspecting their works, and for their hospitality.

Mr. T. H. PRATER, Junior Vice-President (Isle of Thanet Gas Company), seconded this motion.

Mr. THORNTON, in replying to the vote of thanks, expressed his pleasure at seeing the members, and said that he was sure they all appreciated the opportunities which the various gas undertakings gave to their staffs nowadays of allowing them the time to pay such visits. He felt that the co-operation which arose from such visits was all to the good. The gas meter was such an essential part of their organization that he felt it was very useful that they had been together that afternoon. They (the visitors) would now appreciate better the care and skill which had to be given to the construction of the meter, and would also realize some of the difficulties with which meter makers were faced. On the other hand, the firm would gain very much from closer knowledge of the conditions on the districts which the visitors had to meet day by day. Mr. Thornton concluded by saying that despite electricity competition—or, perhaps, because of it—his view was that the gas industry was to-day in a sounder and stronger position than ever, and that, given the continuance of the present policy, with the wise guidance of the National Gas Council, the continual inspiration of the British Commercial Gas Association, and the exercise of their own initiative and energy, past successes were only the forerunner of, and would be eclipsed by, the future progress of the industry.

Mr. ALBERT GLOVER also replied to the vote of thanks, and the proceedings terminated.

GAS EXHIBIT AT PORTSMOUTH.

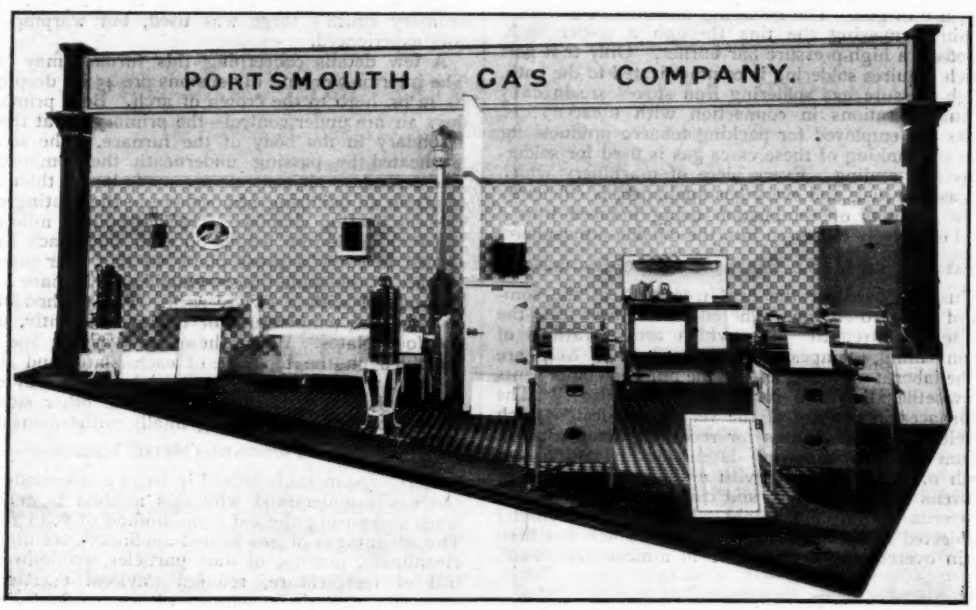


The accompanying photographs show the Portsmouth Gas Company's stand at the recent annual Industries Exhibition held in that town. In past years the Company's stand has been divided into rooms, &c.; but this year it was thought that, if it was made up of two sections, by dividing it diagonally, it would have more attention value. This theory proved to be correct; the unusual shape, combined with the extra length secured for display, attracting considerable attention.

One side of the stand was devoted entirely to gas fires, &c. A screen artist was engaged to paint an image of the sun and its rays, with a view to developing the idea that gas fires give the same healthy, radiant heat as the sun.

The other side of the stand was shown as a model bathroom and as an all-gas kitchen. In the latter section a full week's washing was done in a "Wonder" washing machine each afternoon and evening, causing much interest. Customers were encouraged to bring their own washing, which was washed, dried, and ironed on the stand.

As a result of the exhibit, good business was obtained.



Gas for Coffee Roasting.

There has lately been completed in the metropolitan district of New York City an inquiry to ascertain to what extent gas was being utilized in the coffee and cocoa roasting industries. The survey disclosed the fact that there were forty concerns in this territory roasting coffee or cocoa; seven being cocoa roasters. Of these forty, only six were using coal; the others employing gas-fired equipment. All those using raw fuel stated that they were going to change-over to gas at some future date, or when their present equipment became worn out. Gas possesses many advantages over coal for this work—some of them being obvious. Not the least of the points in its favour is the fact that if, for any reason, the roasting period is carried beyond the time limit, the gas can be turned off and the air blower left operating. This will cause rapid cooling, and possibly prevent a large spoilage. The difference in the time limit must not vary more than two or three seconds, so that the importance of the factor of control can be readily gathered. Referring to the subject in the "American Gas Association Monthly," Mr. J. B. Nealey says that among the world-famous brands of coffee are two which are blended, roasted, and packaged in New York City. The maker of one of these brands formerly roasted coffee with coal, but now utilizes gas exclusively. A set of four gas-fired roasters does the work of sixteen of the obsolete coal ovens. The experience of the other company has been practically the same. In some instances, firms desiring to change-over are not willing to scrap their present equipment. In such a case gas burners and combustion systems are supplied, and the old coal burners can be equipped with them. Even a conversion job of this character is a decided improvement over coal.

WESTERN JUNIOR GAS ASSOCIATION.

A Meeting of the Western Junior Gas Association was held on Dec. 1 at the Gas Offices, Bristol—Mr. T. B. ARMITAGE (Cheltenham), the President, occupying the chair.

INDUSTRIAL USES OF GAS IN BRISTOL.

By C. C. BRICE, of the Bristol Gas Company.

Many of the installations referred to have been fixed under our direct supervision, and in cases of special apparatus fixed by contractors we have been in close co-operation during the period of installation.

COCOA BEAN ROASTING.

The cocoa bean (the chief ingredient of cocoa and chocolate) necessitates a roasting operation prior to its being crushed. High-pressure gas is largely used for generating the necessary heat for this roasting process, and large drums containing the beans are mechanically rotated through the zone of heat. The heat being under perfect control, and requiring no other attention than tap manipulation, ensures an even roast, and obviates the possibility of local heating. Keith-Blackman compressors are used for raising the gas pressure, which is normally 60 in. W.G. Gas is also used extensively for soldering purposes in the making of tin canisters. Blowpipes, &c., are also in use in the engineering maintenance department.

TOBACCO—STOVING AND CONDITIONING.

One of the first operations in connection with the manufacture of tobacco is a process known as "stoving," sometimes called toasting. Gas is used for this stoving process. Surface combustion diaphragms are fitted under large iron trays, and the tobacco, which is spread on the trays, is subjected to a heat treatment prior to its being passed to another operation. It is a peculiar fact that, during its manufacture, tobacco can only be handled in a moist state. Another peculiarity is the different temperatures to which it is subjected in the course of manufacture.

The drying process is one which requires careful control of temperature. Rotating drums are used for this operation, which rotate through a zone of heat generated by gas. The sealing of tobacco tins is an ingenious method which also incorporates the use of gas. The soldering machine resembles a travelling chain, conveying the tins through a solder bath, which is heated by a high-pressure bar burner. Only that part of the tin which requires soldering is communicated to the bath. Numerous high-pressure gas soldering iron stoves are in daily use for various operations in connection with tobacco tins. Large tin cases are employed for packing tobacco products for export, and in the making of these cases gas is used for soldering the seams and sealing. Every piece of machinery which incorporates gaseous fuel, and every gas appliance, is efficiently ventilated, the products of combustion being induced into a main flue, and effectively dispersed into the outside atmosphere.

HEAT TREATMENT OF METAL PARTS FOR AERO ENGINES.

Gas is exclusively used for the heat treatment of the component parts of the aero engine. The laboratory first tests the material for tensile strength, after which the operations of machining, annealing, tempering, case-hardening, &c., are carried out; the laboratory again testing the finished components to ascertain whether they are correctly "normalized." The gas heated furnaces in use are of the very latest design, each being fitted with electrical devices for recording temperatures. The aluminium (as raw material) is melted in gas heated crucibles, each of which is fitted with a tipping device. The core drying ovens are gas-heated, and can be maintained at a constant temperature day and night. Pistons and cylinder heads are subjected to special heat treatment, which has been very helpful in overcoming erosion due to atmospheric conditions.

POWER.

A 6-180 B.H.P. gas engine, direct coupled to 100 KW. dynamos is used for generating part of the electrical load required. Such engines are designed to run on coal gas, producer gas, or a mixture of these fuels. For starting purposes coal gas is used, and also when a heavy electrical load is demanded. Gas is used for the distillation of water; the water being used for electrical storage batteries, this method having been found more beneficial to the plates. Glue-pot heaters, as used in carpenters' shops, are all gas heated, as also are the soldering stoves in the sheet-metal working shops.

The catering departments are equipped with gas heated cooking appliances. The ventilation of the furnaces is excellently maintained, for, though high temperatures are necessary, the shops are not unduly heated, and the products of combustion are all carried off.

CREMATION.

Gas has proved an ideal fuel for this operation. Surface combustion is the method applied for generating the necessary heat. Briefly, the principle of surface combustion consists of passing a mixture of gas and air at a slight pressure through a porous diaphragm of refractory material, which, when lighted on the outer face, will cause the whole face to glow with intense radiance and heat, there being a complete absence of flame. The diaphragm is supported by an air-tight iron frame, which forms a feeding chamber for the mixture of air and gas. These diaphragms are equally spaced in the side walls of the furnace, 36 in all (18 on each side). Each diaphragm is fitted with a separate air and gas control cock; and each side is wholly controlled for operation purposes, such as lighting, extinguishing, and control of temperature. The separate cocks on the diaphragms are used for fine mixture control. The working temperature is between 800° and 900° C., and the length of operation depends on the weight of the mass to be cremated; consumption of gas depending upon the same factor. The gas supply for this installation consists of a 6-in. main, an 800-light dry meter, and a 4-in. outlet. A by-pass is fitted in case of meter defects. The gas is boosted after passing through a syphon box, and from the booster it is passed through a governor, which adjusts the pressure to 12 in. W.G. From the governor the gas is passed through another syphon box, which is fitted with two outlets—one supply for the right-hand side combustors, and the other for the left side. The air pressure is supplied from fans, taking a similar course as the gas, excepting passing through a governor. The necessary secondary air is introduced into the bottom of each side of the furnace, and is controlled by two valves.

OIL CAKE MANUFACTURE.

The manufacture of cattle food in the form of oil cake does not appear to be a process in which gas can be applied; but one of the operations connected with this business, where gas can be employed, is that of pressing. The oil cake in its initial stages is in the form of meal. This meal is spread over canvas sheets, the canvas being placed between two steel press plates, which are subjected to heavy pressure. In course of time and use these press plates become very smooth, and consequently there is no "key" between the canvas and the meal, resulting in uneven section of oil cake. It is necessary periodically to roughen the surface of these press plates; and a gas heated furnace is used for this purpose. Previously an ordinary smith's forge was used, but warping of the plates was experienced.

A few details concerning this furnace may be of interest. The interior working dimensions are 45 in. deep by 24 in. wide by 12 in. high to the crown of arch. Both primary and secondary air are under control—the primary air at the jets, and the secondary in the body of the furnace. The secondary air is pre-heated by passing underneath the combustion chamber. The secondary air controls are made larger than usual in order to attain an oxidizing atmosphere in the heating chamber. Inside the heating chamber, a rack is built of mild steel, supporting four angle-iron ledges on each side; each ledge being intended to carry a press plate, so that four plates are in the furnace at the same time. Outside the furnace a special frame is provided with a swivel rack. The method of operation is to raise the temperature of the oven slightly, and then load the four plates. When these are warm a special powder is sprinkled on the top side of each plate, and this is allowed to melt, when the plates are withdrawn one by one; and each in turn is reversed, sprinkled on the other side, and pushed back into the furnace, being finally withdrawn after one hour.

PRINTING—(METAL MELTING).

Stereotype metal is melted in large gas-heated crucibles. One can easily understand why this method is generally adopted when comparing the old time method of solid fuel application. The advantages of gas heated appliances are made manifest by cleanliness, absence of dust particles, economy of space, control of temperature, reduced physical exertion required of operators, and the apparatus always ready for work. Gas is further used for linotype metal pots, type casters, matrix drying, and glue-pot heating. Gas engines are the general power units for driving the various machines. Gas is used for many further purposes associated with the printing trade, but the number and purposes are too numerous to give details in a paper of this description.

BISCUIT MANUFACTURE.

The appliance used for this process resembles a large oven, which is heated internally top and bottom by high-pressure gas burners, between which a flexible travelling platform is conveyed through the heating chamber. Varying temperatures can be obtained by means of gas control cocks, the class of biscuit deciding the required temperature. Keith-Blackman compressors are used for boosting. The great convenience of gas-heated cast-iron moulds in the manufacture of wafers, &c., for the ice cream trade is very much appreciated. The wafers, being made from a liquid paste, require very quick toasting, and flame contact with the mould gives the desired result very

quickly. Cakes of various kinds are baked in gas-heated steam ovens. These ovens are similar in design to those usually fixed with solid fuel, and, here again, the cleanliness, ease of control, and maintenance of temperature mean that gas is gradually substituting the older methods.

Fibrous Material.

This class of material has to assume many shapes for its various uses. To attain these shapes, heat treatment has to be applied carefully, for, owing to its tensile strength, it is not possible to effect the shaping when cold. The material is placed upon a heated surface, and allowed to remain for periods depending upon its section. When sufficient heat has been conducted, the material is treated under power presses, and shaped accordingly. The necessary heat is generated by a series of gas burners fitted under a cast-iron plate, the material receiving the heat by conduction. To increase the efficiency of this operation, we have recently submitted a new design of apparatus similar to a large double cased oven, but without doors. The plate is heated by four bar burners at equal distances apart, the flue gases passing through an annular space at the sides of the oven. This available heat is utilized for a pre-heating process. It is obvious that flame contact must be avoided; hence the suggested design.

Artificial Limb Making.

Fine, complicated, yet strong springs, and ingeniously shaped metal attachments comprise the greater portion of an artificial limb. These attachments differ in form and construction, each being treated on its individual merits. For forging, annealing, tempering, &c., gas heated appliances are used. A gas heated smith's hearth and blowpipe, together with a muffle furnace, represent this installation, which is proving very efficient, as the space available for such operations is limited.

Boot and Shoe Manufacture.

The progress made in the manufacture of boots and shoes during the last few years is very striking, and gas has become an important factor in this work. Gas supplies the necessary heat for ironing the textile material; for melting the wax used in connection with stitching the welts; for toe-piece ironing (the toe-piece is responsible for keeping the toe of the shoe hard); and for sole burnishing, where a high-speed burnisher, internally heated, is the medium employed. Edge setting, and many other minor operations associated with this industry embrace the use of gas.

Paper Bag Manufacture.

In the manufacture of these goods, gas is used for two operations—paste making and seam drying. The paste making apparatus consists of a gas heated tank, the ingredients being stirred by a mechanically driven agitator. The seam drying arrangement is really a large fly-wheel heated at the rim. The completed bags are conveyed round this wheel, as the final operation. The contact of the bag with a heated surface has the effect of drying any blobs of paste, thereby preventing adhesion in the packing.

Papier mâché in the raw material is in pulp form. The pulp is placed in gas-heated moulds, and shaped by a hand operated press. The special value of gas in this case is the ease by which the correct temperature can be maintained. This business, as far as I know, is quite new. In deciding upon the correct design of burner and control devices, many experiments were carried out, and my Company finally designed and applied a series of burners which has proved efficient. It is very necessary that local heating of the moulds be obviated, or the bowls in the making would be spoiled.

The Motor Industry.

There are numerous other industries acknowledging gas as a useful servant. The motor industry is deserving of mention, the uses of gas here being chiefly associated with petrol and oil tank making, power generators, engine testing, frame brazing, and japanning ovens. Time does not permit me to enumerate other industries, but it may safely be said that present-day manufacturers are now realizing the importance of gas for industrial purposes. The installation of a gas supply in many cases substitutes a solid fuel bunker. Ground space, which hitherto was used for an ash dump, can be utilized for more profitable purposes. There is much evidence of the close co-operation between the industrial appliance manufacturers and the gas industry in respect to design and suitability of apparatus to meet the special requirements of the various trades, the effect of which must result in higher efficiencies and simpler control—both vital factors for the success of gas as a fuel.

There followed an interesting discussion, in which the President and Messrs. Conway, Bateman, Cullington, and Malsbury took part.

A number of exhibits dealing with the subject were explained, and a vote of thanks was proposed by Mr. Lloyd (Weston), seconded by Mr. Cullington (Stroud), and passed unanimously.

TWO-PART GAS RATES FOR SANTA BARBARA.

By Joseph M. Berkley, Consulting Gas Engineer, Los Angeles, Cal.

[From the "Gas Age-Record" for Nov. 17.]

In order that the cost of gas service might be more equitably divided between consumers, and that each consumer may more nearly bear his just proportion of the same, it has been the pleasure and privilege of the author of this article to introduce into California what is known as the "two-part rate."

This rate consists essentially of two parts:

(1) A consumer charge which is uniform for all consumers by classes, and which covers certain fixed charges, expenses, and operating costs, such as overhead, office, maintenance and operation, meter-reading, billing, &c. This charge does not carry any gas.

(2) A uniform charge for the gas served at a fixed rate per 1000 c.ft. used. Under this charge there are billed to each consumer those expenses which vary directly with the amount of gas which the utility must supply, and these charges are billed to each consumer directly in proportion to the amount of gas that he consumes.

In all recent California rate cases the question of varying temperatures has been introduced in such a way as to become a matter for serious consideration in the fixing of rates. The adoption of a two-part rate will be the most helpful element of which we know to eliminate this serious effect, because it will immediately stabilize and produce a steady revenue which will balance the income during the period of high temperatures, and will straighten out the load curve for the twelve months' period as nothing else can or will do; and if a ready-to-serve charge is not a burden in the winter time, it cannot consistently be judged as a burden in the summer time. On the other hand, the consumer should be willing to accept his part of the responsibility of having gas at his command as much in summer as he does in winter; and it is our belief that the two-part rate is the solution of the temperature problem, at least in California.

It has been argued that the minimum user will be penalized by the adoption of a two-part rate, while an actual investigation made by the gas company shows that out of 395 consumers in the gas-works district, which is occupied by people of perhaps lesser means in Santa Barbara, 27 p.ct. would show an increase of 10d. per consumer per month, 73 p.ct. would receive a reduction of 3s. 10½d. per month, and an over-all reduction would amount to 2s. 5½d. per consumer. It is well known that any minimum consumer on any gas company's line is a liability, and undoubtedly pays a higher rate per 100 c.ft. for the gas he actually uses on the block rate schedule than he will under the two-part rate. There is nothing in the present system of making rates to encourage the minimum user to get more for his money, but in the two-part rate there is every reason to encourage him to use gas for other purposes where it is possible; and it is manifestly unfair to carry minimum consumers at the expense of those who have uses for quantities of gas above the minimum user. It is also manifestly unjust to maintain a schedule of this character which encourages that class of consumer to demand service, for just in proportion as they number to the total number of consumers, in that proportion they become an added liability. It is my conclusion that the two-part rate will, on the one hand, discourage the carrying of this liability on the books of the Company, and will, on the other hand, encourage the small user who pays his 4s. 2d., if that be the service charge, *plus* 4¼d. per 100 c.ft. for the gas he uses, to employ more gas and be benefited by a lower average rate than he now pays per 100 c.ft. under the minimum rate schedule.

Other Californian Cities Expected to Follow.

The order went into effect on July 9, 1928, and reports obtained from the Company and the Railroad Commission indicate that far more compliments than objections are heard.

The new rates as established by the Commission were, for all domestic and Class A consumers, 4s. 2d. per month consumers' charge and 4¼d. per 100 c.ft. for all gas used. There were other schedules for larger users—industrial, &c.

In another rate case we recently submitted to the Commission in four other cities and towns 30 miles south of Santa Barbara, we, with the utility, asked for a two-part rate to be ordered; and it is the belief of the writer that a two-part rate will be granted, and that California, within the next two or three years, will have most of her companies operating on these better forms of rates.

AMERICAN GAS ASSOCIATION CONVENTION.

During a highly successful convention at Atlantic City during October, Mr. Oscar H. Fogg, of the Consolidated Gas Company of New York, was re-elected President of the American Gas Association, and Mr. B. J. Mullaney, of the People's Gas Light and Coke Company, Chicago, Vice-President. A large number of reports and papers were submitted; among the former being those of the Treasurer (Mr. Clifford E. Paige, of the Brooklyn Union Gas Company), and of the Managing Director (Mr. Alexander Forward).

THE COKE SITUATION.

The most voluminous of the reports, and the one to which the gas engineer instinctively first turns, is that of the Carbonization Committee, whose work is dealt with in five sections. The first of these considers some economic aspects of the coke situation in 1927. That year, it is evident, witnessed a pronounced trend towards the substitution of coal gas for water gas; and this being so, the Committee find themselves faced with the question as to the utilization and disposal of the additional coke presumably available from increased coal gas production. The changes in methods of gas production are reflected in the fuel requirements of the industry. The amount of anthracite coal used has become almost negligible in recent years, dropping from 600,000 tons in 1926 to less than 300,000 tons in 1927—a 50 p.ct. decline. The bituminous coal used by the industry for all purposes in 1927 amounted to 9,400,000 tons, an increase of 5 p.ct.; while the coke requirements rose from 4,227,000 tons in 1926 to 4,567,000 tons in 1927, an increase of 8 p.ct. Of this coke employed within the industry, over 3,000,000 tons were used as generator fuel for water gas, and over 1,500,000 tons as bench and boiler fuel. This last item represents an increase of approximately 30 p.ct. over 1926.

VALUE OF UNIFORMITY IN QUALITY.

The fact is emphasized by Mr. H. M. Chapman that uniformity of quality is of greater value even than standard of quality. This follows from the fact that almost any process employing coke will suffer more from a mal-adjustment due to variation in performance from day to day than it will suffer from the use of an inferior coke, if only it be reliably inferior. A supplier of low-priced coke, for instance, is not excused for furnishing a batch of better coke, on occasion, by the circumstance that he is giving the customer more than he has paid for. The customer is really getting something less than he bargained for—namely, a reliable performance, to the presumed character of which his processes are adjusted. Such misbranding does not have to be deliberate and intentional to be unethical. It may be due merely to taking too much for granted, and assuming that the factors of production have remained constant when they have, as a matter of fact, changed. So far as the customer is concerned, the result is still misrepresentation. He points to the fact that usually more care is expended upon maintaining a uniform flow of gas than upon producing a uniform coke.

ORDER OF SCREENING.

Mr. L. E. Knowlton finds great difference of opinion as to the proper sequence of screens—whether the smaller or larger sizes should be removed first. In general, the material passing over the first screen will contain the greatest percentage of under-sizing, because that screen is most heavily loaded. This tendency may, no doubt, be overcome by provision for excess capacity on the first screen as compared with subsequent screens. If the smaller material is removed first, then the overs from each screen may be fed directly on to the next succeeding screen, and the material passing through the screens may go direct to bins. If, however, the order of screening removes the large size first, a more complicated lay-out is necessary. The overs from each screen must be handled by chutes leading at right angles to the direction of the stream of material as it is discharged from the screen. The material passing through each screen must be fed to the next succeeding screen by a chute or hopper and conveyor. Certain combinations of the two schemes are possible, and work out well in practice.

Efficient separation is, of course, nullified if subsequent handling of material causes breakage, thus introducing under-sizing. Curved chutes so shaped as to move a stream of coke without impact at any point on the chute, or in the delivery to and from it, reduce breakage. All bins of appreciable depth should be filled by spiral chutes, to prevent impact as the coke is dropped into the bin. There should be sufficient spirals to fill a large bin at several points. This increases the working capacity of the bin, and reduces segregation of size as the material piles-up in the bin.

The presence of dust in coke that is otherwise well sized will prove a source of annoyance to consumers and a cause of complaints to the producer. Domestic coke should be sold on a basis of reasonable moisture content—perhaps 3 to 6 p.ct.—but it should be delivered with sufficient moisture to prevent the scattering of dust about the cellar when it is put in the fuel bin. If the coke contains a considerable quantity of dust, it may be thoroughly wetted after being weighed, or previous to weighing with allowance in the weighing for the addition of this moisture. There is a possibility that with rather dry coke this dust may be removed with air cleaners; but if there are at present such applications of cleaners, they have not become known.

The subject of coke sales was dealt with editorially in the "JOURNAL" last week.

BLUE GAS v. PRODUCER GAS FOR HEATING CARBONIZING UNITS.

In 1922, at the Convention of the American Gas Association, Mr. Reed Morris, of Seaboard, read an excellent paper dealing with the carbonization of coal with blue gas and producer gas. This paper has aroused considerable discussion and debate during the last few years, owing to the fact that many operators claim that, with the improvement of blue gas apparatus and operating methods, the conclusions which Mr. Morris drew are no longer correct. In order to determine to what extent these claims are justified, a Sub-Committee have attempted to gather as much data as possible on modern blue gas practice. In so doing, it was surprising to find how little information was available from which any definite conclusions could be drawn. Any data which it was possible to obtain were of questionable nature, due to shortness of the tests and the assumptions which it was necessary to make. For this reason it did not seem advisable to the Sub-Committee to go too deeply into the matter at this time.

In order to bring the subject to the attention of the Association, however, the Sub-Committee review Mr. Morris's conclusions, and bring them up-to-date as far as practicable with the data available. They indicate the more important developments which have improved blue gas manufacture during the last six years. These improvements constitute: (1) The use in suitable localities of soft coal in blue gas generation; (2) the employment of the back-run, which has rendered possible greater fuel economies in blue gas operation; and (3) the self-clinkering grate, which has resulted in large savings of labour and fuel, together with an increase in capacity consequent upon the elimination of clinkering periods. In spite of these improvements, however, they remark that, judging from the information they have been able to obtain, there is still a balance in favour of producer gas from an economic point of view. There are very few actual operating figures available as to the fuel used by a modern blue gas set; but the experience of several plants is that it may be possible to reduce the fuel per 1000 c.ft. of blue gas from the amount which Mr. Morris used—namely, 37 lbs.—to 32 lbs. In other words, with a modern blue gas set, it now requires 10·5 p.ct. more fuel to carbonize a ton of coal with blue gas than with producer gas, instead of 23·7 p.ct., as shown by Mr. Morris. However, there are not many plants which are able to equal these results, and blue gas is still at a disadvantage as far as fuel economy is concerned.

It is remarked that it is more difficult to obtain uniform heating using blue gas than with producer gas. Producer gas gives quite uniform heating in either vertical or horizontal flues, owing to the fact that both the high percentage of inerts and the large volume of air necessary for combustion contribute to produce a long flame. On the other hand, blue gas which requires a small amount of air for combustion gives a short flame and a small volume of products of combustion to distribute the heat to the oven walls and regenerators. This means that in order to coke a charge completely part of it must be over-coked, which requires additional fuel.

The recovery of waste heat from the products of combustion of blue gas or oven gas is not as great as with producer gas, because of the fact that the heat capacity of the air and producer gas, both of which are preheated, is nearly the same as the heat capacity of the products of combustion; while in using blue gas or oven gas with which only the air is preheated, the heat capacity of the air is much less than the heat capacity of the products of combustion, which results in a loss of heat by way of the stack. This also requires additional fuel.

Mr. Morris, in his paper, arrived at the following general conclusions: As a part of a large bye-product plant furnishing gas for city use a blue gas plant has advantages over a producer plant in times of coal shortages. Also during a business depression, when the market for coke is poor and prices low, a blue gas plant is desirable, because more blue gas than producer gas can be mixed with the coal gas, which means that a greater percentage of coke can be turned into gas.

"However for anything like a steady operation a producer plant is a far better proposition (1) because of its greater efficiency in change heat units in form of carbon to a combustible gas, (2) because of the simplicity and ease of operation, and (3) because of the lower manufacturing costs." The Sub-Committee remark that this conclusion is practically as true to-day as it was six years ago; but to determine exactly the extent to which it is correct, they recommend that tests be carried out.

COMPARISON OF PLANT TEST RESULTS.

It is reported by Mr. T. A. Mangelsdorf, of the Massachusetts Institute of Technology, that the results of tests on four different carbonizing plants show a striking similarity. The plants comprised Koppers coke ovens at Utica, U.G.I. intermittent verticals at Rochester (N.Y.), horizontal through retorts at Lowell (Mass.), and Glover-West continuous verticals at Stamford (Conn.). Only in the case of the continuous vertical retorts, which were steamed to the extent of 12 p.ct., is there any great difference. The over-all heat balance may be briefly summarized as follows:

—	Utica Ovens.	Rochester Verticals.	Lowell Horizontals.	Stamford Continuous Verticals.
	P.Ct.	P.Ct.	P.Ct.	P.Ct.
Heat input—				
In the coke	11·25	12·09	9·37	10·93
In the coal	88·07	86·93	89·33	87·72
In the steam	0·00	0·07	0·00	0·89
Other items	0·68	0·91	1·30	0·46
Heat output—				
Coke made	55·70	56·30	56·20	55·62
Gas made	20·25	18·76	20·72	23·60
Tar made	5·87	5·70	5·81	6·97
Total for three major products	81·82	80·76	82·73	86·19
Sensible and latent heat in these products	5·28	4·69	5·00	2·11
Other heat accounted for	7·23	9·88	7·29	9·18
Heat unaccounted for	5·67	4·67	4·98	2·52

It will be seen that the heat of combustion of the gas is 23·6 p.ct. in the case of the Stamford plant, as against 20·25 p.ct., 18·76 p.ct., and 20·72 p.ct. for Utica, Rochester, and Lowell respectively. This difference is indicated more clearly in the table below.

—	C.Ft. Gas per Lb. Coal.	B.Th.U. per C.Ft.	B.Th.U. per Lb. Coal.
Utica ovens	5·66	573	3245
Rochester verticals	5·67	540	3065
Lowell horizontals	6·06	542	3280
Stamford continuous verticals	7·15	530	3790

These figures show that the ovens and horizontals give about the same B.Th.U. per pound, that the figure for the intermittent verticals is somewhat lower, and that the value per pound for the continuous verticals is considerably higher than any of the others. The low value for the intermittent verticals may, it is said, be explained by the fact that the plant was not new when tested. A previous test on the same plant showed considerably better results. The excellent figures obtained with the continuous verticals must be credited to steaming. This conclusion is substantiated by an extensive series of tests carried out in England, which showed that steaming aways increases the gas yield and the B.Th.U. per pound. It has been shown likewise that steaming increases the tar yield. It might be expected that, with the increases in the gas and tar yields due to steaming, the coke yield might be materially reduced; but this does not seem to be the case.

The Utica, Rochester, and Lowell tests showed little difference between the ratio of heat output in the form of coke, gas, and tar, and the heat input in the form of coal. Due largely to the increased gas yield and lower carbon loss, this ratio for the Stamford plant is somewhat higher:

Ratio of Heat Output in the Form of Coke, Gas, and Tar, and the Heat Input in the Form of Coal.	
Utica ovens	92·90
Rochester verticals	92·90
Lowell horizontals	92·62
Stamford continuous verticals	98·26

It is pointed out that this is not exactly a fair comparison, since there is a heat input in the form of steam in the Stamford retorts which amounts to approximately 1 p.ct. of the heat input as coal.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

"Regenerative" Coal Gasification System.

SIR,—It is very largely due to the generous assistance which has been given us by the Preston Gas Company, through their Engineer and Manager, Mr. Samuel Tagg, to whom we also owe many valuable suggestions, and also to Mr. Heald and Mr. Collinge, members of the staff of the Company, who have had charge of the plant, and who have co-operated with us in the experiments which we have carried out, that we have been able to overcome so many of the difficulties which we have encountered, and which anyone embarking on an enterprise of this kind must necessarily face.

The plant has been in operation for just three years, and, as they tell me at the works, it has never given any trouble. However, instead of attempting to amplify Mr. Collinge's account of it, I prefer to call attention to the fact that Mr. Tagg has kindly consented to permit anyone who may be interested in the process to see the plant in operation, and any questions which any visitor may wish to ask will be answered quite frankly. Mr. Collinge is able to give information on points of detail which he has not considered in his paper, and to deal with some of those raised in your article of this week's issue.

I only wish to add that when Mr. Clark and I took up the study of the problem six years ago, I found that the water gas process had only been partially investigated from the thermal standpoint, and no one had attempted to explore the problem of complete gasification on scientific lines. Such attempts as had been made to design processes for the complete gasification of coal had not been based upon scientific investigation, and could only operate successfully in contravention of the law of the conservation of energy. However, having established the fact that the thermal requirements of the process could be satisfied by means of the regenerative system, the problem resolved itself into one in which the obstacles to success were entirely in the domain of engineering. The problems involved became closely analogous to those which have arisen in the development of the modern gas producer as it is found in steel works or glass works.

You note with surprise that the plant is capable of producing gas of 360 B.Th.U. at 171 therms per ton. From thermal considerations, making only such assumptions as are universally admitted to be permissible in dealing with technical problems, it is quite clear that a very much higher efficiency should be attainable, and that the efficiency must ultimately depend upon the extent to which certain purely mechanical problems, upon which the working of the process depends, can be satisfactorily solved. In matters of this kind it is very important to distinguish sharply between possible thermal efficiency and the efficient working of the mechanism of a plant, for while the one has a definite upper limit, in the other the term *efficiency* is not used in a scientific manner, so that the mechanical operation of a plant may be brought to practical perfection. The thermal efficiency of the process is subject to the laws of thermodynamics; the mechanical efficiency is a matter of the skill of our engineers, the money available for experiment, and, not least, the assistance of our friends. All these facts must be considered when arriving at an estimate of the kind to which I refer.

M. W. TRAVERS.

147, *Queen Victoria Street, E.C.* 4.
Dec. 6, 1928.

The Gas Lighting Load.

SIR,—It was noted with great pleasure, in a recent issue of the "JOURNAL," that Mr. Milbourne, at a meeting of the Society of British Industries, brought forward prominently the question of gas lighting; and it is hoped that all possible publicity will be given to this branch of our business. On the other hand, there is a sense of disappointment that Mr. Milbourne's strong appeal to the industry brought forth no reply or rejoinder in your issue for Dec. 5.

In many cases, for a number of years past, there has been a tendency to allow the enormous development of the cooking, heating, and industrial loads to absorb the energies of those responsible, leaving the lighting load very largely to look after itself; in some cases there has been positive inertia as far as this branch of the business is concerned. Nothing could be more erroneous, for there is no question that the greater portion of the lighting of the houses of any town is pre-eminently the gas "field;" and during recent years, the special attention given to this matter has strengthened the views of those who have attempted campaigns to consolidate this load.

In the first place, the majority of our population have to work for their living, and have an interest in the economical running costs of their home. At the present time, when money is scarce, the cheapness and other advantages of gas lighting have a strong appeal, for since the war the modern house has been probably of thinner wall structure, and more often either detached or semi-detached, and there is consequently quicker loss of internal heat than in the stone-built or street-erected houses.

The facts that with the average price of gas one penny gives five hours' light of some 50 to 60 candle-power, and serves not only as an illuminant, but warms and ventilates the room, are greatly appreciated, especially by the prepayment consumer.

In the chilly autumn evenings, or when damp weather prevails, the incandescent burner is often utilized to "air" a room, instead of the housewife having to lay and light a fire; and this advantage is also appreciated by the worker who leaves home in the early morning, and the worker who, arriving home late at night, has to have his supper when the fire has died down.

The prime cost and the cost of replacements of burners, mantles, &c., are small when compared with those for electric bulb renewals. This is another important factor to the small householder. For this and other reasons, gas lighting holds among a large proportion of the population a position which electricity, however boomed, cannot easily displace.

Therefore, it behoves the industry to utilize these advantages to the utmost, and refuse to shelve the question which vitally affects its service to consumers. It is to the mutual benefit of the gas supplier and the gas user that great and consistent propaganda should be devoted to the special subject of lighting.

A few years ago, the Company which I have the honour to serve, and which has an output of over 2000 million c.ft. per annum, adopted a standard incandescent 4-part burner of a type suitable for the gas supplied in its area; and as a form of service, these burners were sold at the showrooms, and orders taken to fit them, complete with mantle, for 2s. 6d. each. The necessary publicity was given to this offer, and immediately a quickened interest was displayed in gas lighting.

As a result of experience gained by this policy, and as a further incentive, a wide selection of modern fittings, including bowl lighting, has been placed upon a hire-purchase system, with four quarterly payments. A catalogue has been produced showing exactly the types of fittings, and the quarterly charge, which includes fixing; and this arrangement, whereby modernized lighting fittings are placed at the disposal of the consumer without heavy initial expenditure, has proved very attractive, and has created a big demand for modernized gas lighting.

Then again, there is the question of prepayment consumers. Probably most undertakings have from 30 to 50 p.ct. of their consumers taking prepayment supplies; and the undertakings have themselves borne the initial cost of the installations. It is advisable to see that such installations are up to date; and my Company has adopted the policy of modernizing the whole of such fittings, replacing them with solid-drawn tubes, modern burners, and mantles and globes complete—a service which is greatly appreciated by this type of consumer. In a large number of cases the consumer himself purchases additional complete points for lighting, and has them fixed by the Company.

Where consumers are subject to heavy electrical competition, and the houses are being canvassed for electrical carcassing on the deferred payment system, it behoves the industry to see that special attention is given to the lighting fittings, and that modern fittings are available at reasonable prices, so that this service shall be placed on the same plane as that of the cooking, heating, and industrial loads. Experience has shown that modernized gas lighting under such conditions can well hold its own against electrical competition, especially so where such competition covers a free wiring service with a high price for electric current to redeem the cost of the expenditure incurred in wiring.

Concerted action in a lighting campaign should be made by a united effort—that is to say, special lighting windows should be arranged at the showrooms, consumers should be notified by means of a pamphlet delivered with the quarterly accounts of the possibilities existing, and there should be notices in the Press indicating the lighting facilities offered by the undertaking. A few years' experience of the foregoing system of campaign has vindicated the policy that a strong campaign on lighting, at the same time giving good service, will amply pay for itself.

It is to be hoped that the "JOURNAL" will continue to press home the case for domestic lighting, and that Mr. Milbourne's plea will arouse deep interest on the part of those who have been inclined to let the lighting load look after itself, inasmuch as a system of poor gas lighting in any area may easily have an adverse effect on areas adjoining.

"LUX."

Dec. 8, 1928.

REGISTER OF PATENTS.

Forced Draught Mechanical Grates.—No. 300,187.

GAS LIGHT AND COKE COMPANY, of Horseferry Road, S.W. 1, ADAM, W. G., and GRAY, P., both of Beckton, E.

No. 20,888; Aug. 8, 1927.

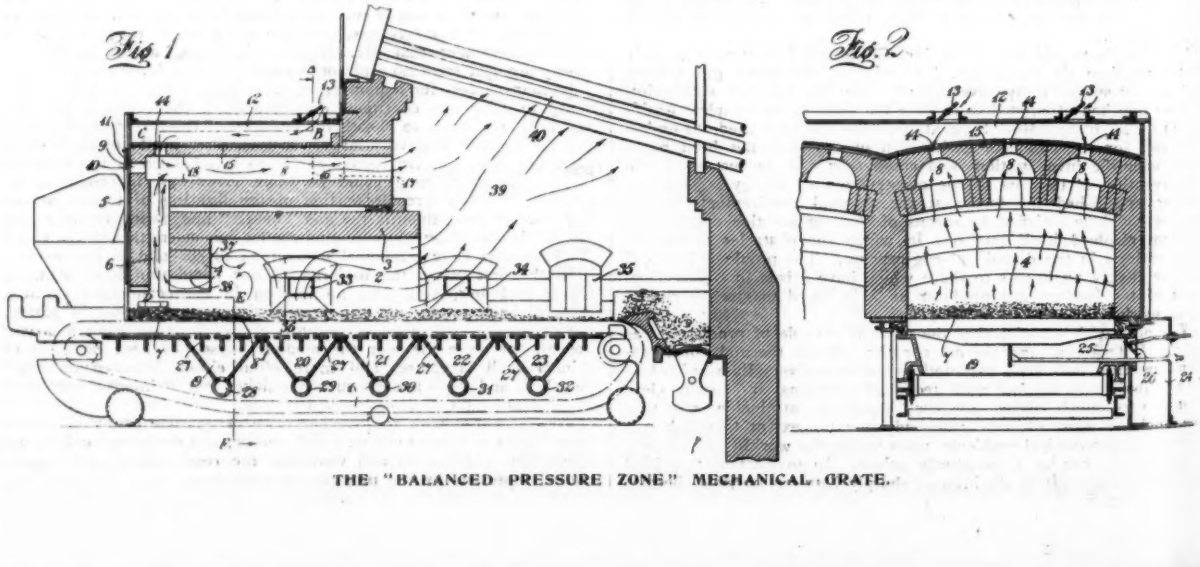
This invention relates to furnaces having mechanical stokers and preferably operated with forced draught, and more particularly to those in which the fuel is coke breeze; but it should clearly be understood that coal, coke, slack, or other solid fuel may be used.

The invention has for its object to provide an improved method of assisting or accelerating the ignition of green or incoming fuel into the furnace, and also to provide an improved construction of furnace particularly adapted for the purpose. The method of assisting the ignition of green fuel consists in creating a balanced pressure zone crosswise of the furnace at any one place longitudinally of the grate and within the length of the arch or combustion chamber and above the fuel, and withdrawing or expelling the moisture together with part of the unburnt gases and/or products of combustion from above the green fuel and/or incandescent fuel through a vertical passage or passages thereabove and a passage or passages leading therefrom to a chimney or to any place where it is desired to utilize the heating effect of the evolved gases. The term "balanced pressure zone" is intended to mean a zone where the gases evolved from the fuel divide and flow in opposite directions.

Fig. 1 is a longitudinal section of so much of a furnace as is necessary to illustrate the invention; and fig. 2 is a cross-section on the planes A—B, C—D, E—F.

The travelling chain grate 1 is of any suitable and well-known type, 2 is the combustion chamber, and 3 the roof of the combustion chamber. At the feed end of the furnace the roof 3 of the combustion chamber is provided with a downward portion 4 preferably of arched formation on its lower face, as shown in fig. 2; and behind it is a passage 6 preferably vertical. The passage 6 is disposed above the green fuel 7 and at any desired position between the front 5 of the furnace and the approximate beginning 8^1 of the incandescent fuel. The passage 6 is in communication preferably with passages 8 above the combustion chamber 2 and the roof 3. The passages 8, which may extend forwardly as shown, may be inclined upwardly and/or downwardly, or they may be horizontal as shown. The furnace front ends of the passages 8 communicate with passages 9 through which and holes 10 in the furnace front secondary air can be admitted to the passages 8. The amount of secondary air admitted through the openings 10 and passages 9 to the passages 8 may be controlled by dampers 11 or other suitable devices. Above the passages 8 a space 12 may be provided into which secondary air can be admitted through controlling dampers 13 which may be operated individually or collectively by hand or mechanically. The air in 12 may pass through openings 14 in the furnace roof 15 and thence into the passages 8. Any one or all the passages 8 may be blocked as shown in dotted lines at 16.

Although fig. 1 shows the evolved gases being utilized for heating boiler tubes, it should be clearly understood that any one passage 8 or all such passages may be blocked at the forward end or ends, in which case the gases may escape by side passages 17 in communication with a chimney or with passages to convey the heating gases elsewhere. Further the passages 8 may be omitted, in which case the gases may escape through lateral passages 18 provided at the feed end of the furnace and in communication with the passages 6. Nos. 19, 20, 21, 22, and 23 are forced draught compartments into which pressure air is delivered through the passages 24 and 25, the amount and pressure of the pressure air or forced draught being controlled by a damper 26. Above the compartments are **T** bars represented generally by the reference numeral 27. 28, 29, 30, 31, and 32 are ash valves; 33 and 34 are inspection openings; and 35 is a door through which access can be had to the furnace.



THE "BALANCED PRESSURE ZONE" MECHANICAL GRATE.

One position of a balanced pressure zone is indicated in dot and dash lines at 36. The arrows on each side of this line indicate the paths of the gases evolved from the incandescent fuel on the right-hand side of the line 36 and the gases evolved from the green fuel 7 and/or part of the incandescent fuel 8^1 on the left-hand side. It will be understood that by suitable manipulation of the forced draught and the suction-draught and/or by manipulation of the forced draught a balanced pressure zone in the furnace can be created at any desired position longitudinally of the grate, so that the gases on the one side of the zone 36 can be caused to move to the right, and the gases on the other side to the left so as to impinge on the roof of the furnace 3 and faces 37 and 38 of the downwardly extending portion 4. The latter is thus heated by radiant heat; and in view of its proximity to the incoming fuel assists in or accelerates its ignition. The backwardly moving gases escape as indicated through the passage 6 and the passages 8 to the space 39. The heating effect of both backwardly and forwardly moving gases in the example of furnace shown is transmitted to the boiler tubes 40.

Examples of actual working conditions are given.

Waterless Holders.—No. 286,740.

JAGSCHITZ, K., of Mainz, and KUEHN, P. M., of Baltimore.

No. 7507; March 10, 1928. Convention date: March 10, 1927.

This invention relates more particularly to the means employed for withdrawing the used sealing liquid from the lower portion of the holder, separating the water therefrom, and thereafter securing proper distribution of the sealing liquid to the upper portion of the holder.

Separation of the Neutral Constituents from Low-Temperature Tar and its Fractions.—No. 287,471.

BUNGE, F. C., of Mikolow, Poland.

No. 11,806; May 3, 1927. Convention date: March 21, 1927.

This invention relates to a process for separating the neutral constituents from low-temperature tar or its fractions. Hitherto, says the patentee, this has been done by extracting the acidic constituents with alkaline reagents. Processes have also been described in which tar oils, tars, or fractions have been treated with various acids, mostly sulphuric acid, for the purpose of obtaining various constituents. The present invention consists in treating the tar with phosphoric acid at ordinary temperatures or with heating.

If, for instance, low-temperature tar, which is preferably mixed with a neutral diluting agent, or a low-temperature tar freed from pitch is treated with phosphoric acid at an ordinary temperature or while heated, the acid constituents combine with the acid, while the neutral constituents remain unaffected and can be separated off. After separation, the neutral constituents are treated again with phosphoric acid in the same manner and thus further purified; the washing acid used for the second purifying operation being used subsequently for the treatment of a fresh batch. If low-temperature tar is used as primary material, the separated neutral constituents obtained in the first washing with acid can be used as the diluting agent.

The neutral oils can be further treated according to the known process, or be used directly. The acid constituents obtained have the property of forming very stable emulsions with water. They can be used without further preliminary for flotation purposes. They also act as disinfectants. The acid constituents may also be separated from the phosphoric acid again by the addition of compounds combining with phosphoric acid; and the acid constituents are in this way obtained in an almost pure form.

Wet Gas Meters.—No. 299,935.

THORF, F., BUTTERWORTH, E., and the ROTARY METER COMPANY, LTD., all of Kennington Road, S.E. 11.

No. 21,686; Aug. 17, 1927.

The object of this invention is to provide an improved construction and arrangement of metering mechanism which is light and efficient in action, gives a large delivery of gas in relation to the size of meter, and is particularly suitable for large station meters.

Broadly, it comprises provision in a wet gas meter of a plurality of interconnected pairs of bells, each pair constituting a balanced unit and being contained in a separate gas section of the meter, and each bell being contained in a separate compartment of a section, the space above one bell in its compartment being in communication with the space below the other bell of a pair, and the relative operative positions of the several pairs of bells at any moment being such as to provide a continuous gas delivery from the meter.

This constitutes the chief claim, appended to which are seven others. The subject of the patent is fully described; and there are ten sheets giving twenty drawings.

Retort Settings.—No. 299,795.

LOW TEMPERATURE CARBONISATION, LTD., of Clement's Inn, W.C. 2, and PARKER, C. H., of Codsall.

No. 11,295; April 27, 1927.

This invention has among its objects to construct a setting by which heat may be simply and effectively applied to the retorts, and with economy in the utilization of the gaseous fuel employed, and in such manner that the respective parts of the plant—for example, the retorts and recuperators—may be conveniently mounted in the setting and be capable of convenient withdrawal when repairs or renewals are to be made.

The invention is especially applicable to vertical retorts of oblong cross-section that are disposed in parallel series in the same setting, and in which the retorts are charged and discharged periodically. It is further especially applicable to a setting provided with two series of alternate retort chambers and substantially co-extensive combustion chambers, and with a series of recuperator chambers in position between the series of retort chambers and combustion chambers; one series of recuperator chambers being advantageously provided for two adjacent and parallel series of alternate retort and combustion chambers.

The main claim is as follows: Settings for vertical retorts for the distillation of solid carbonaceous substances, comprising alternate retort chambers and substantially co-extensive combustion chambers arranged in two series, and recuperator chambers in position between the series of retort chambers and combustion chambers, the series of alternate retorts and combustion chambers being provided in spaces formed between parallel disposed longitudinal walls and the end walls of the setting, and the recuperator chambers being formed by integral transverse parallel walls disposed between the adjacent and parallel disposed longitudinal walls; ports or passages being provided at the upper ends of the recuperator chamber in the parallel disposed longitudinal walls communicating with the adjacent and oppositely disposed combustion chambers, and openings or arches being formed at the lower ends of the transverse walls through which the heating gases may be discharged from the respective recuperator chambers.

Other claims are appended; and the invention is described in detail and in relation to drawings.

Wet Gas Meters.—No. 300,096.

FLETCHER, J. A., and NORMAN, C. R., both of Stalybridge.

No. 14,326; May 16, 1928.

This invention has for its object to provide improved means for minimizing the rusting and corrosion of the internal parts of wet gas meters. It provides that the liquid used in the meter may be an oil emulsion produced by intimately mixing soluble oil or a mixture of soluble oils with water. The oil may be in solid or liquid form. Preferably, it is a mixture of animal, vegetable, and mineral oils in the emulsion. It does not render the meter sluggish in operation.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 5.]

Nos. 34,698—35,499.

GASKIN, R. W. E.—"Gas meters." No. 34,834.
GENERAL GAS APPLIANCES, LTD.—"Water-heating systems." No. 35,271.
HOLTER, A.—"Gas meters." No. 34,835.
ILLINGWORTH CARBONIZATION COMPANY, LTD.—"Treatment of products from carbonization of coal." No. 35,230.
ILLINGWORTH CARBONIZATION COMPANY, LTD.—"Plant for carbonization of coal." No. 35,264.
KEEFE, J.—"Gas heating apparatus." No. 35,061.
POOLE, D. C. E.—"Gas meters." No. 34,700.
SMITH, E. W.—"Gas meters." No. 34,833.
SMITH, E. W.—"Gas meters." No. 35,219.
SMITH METERS, LTD.—See Smith, E. W. No. 34,833.
SMITH METERS, LTD.—See Gaskin, R. W. E. No. 34,834.
SMITH METERS, LTD.—See Smith, E. W. No. 35,219.
WILSON, J. H.—See Poole, D. C. E. No. 34,700.

PARLIAMENTARY INTELLIGENCE.

[From Our Special Correspondents.]

HOUSE OF LORDS.

Special Orders.

The following Special Orders have been laid before the House, and referred to the Special Orders Committee: County Borough of Burnley; Petersfield and Selsey Gas Company; Bishop's Stortford, Harlow, and Epping Gas and Electricity Company; City of Bradford; Redhill Gas Company (East Surrey Order); Leek Urban District Council; Borough of Rochdale; and Rugby Gas Company.

HOUSE OF COMMONS.

Special Orders.

Special Orders proposed to be made on the application of the City of Bradford and the Borough of Rochdale have been presented to the House and ordered to lie upon the Table. Plans have been deposited in connection with the Exmouth Gas Order.

Railway Freight Rebates.

Mr. WILL THORNE (Labour M.P. for Plaistow) asked the Minister of Transport whether coal used in coke ovens for making coke and bye-products would be designated productive coal, and whether a reduction in railway rates for freightage would cover this class of coal.

Colonel ASHLEY, in reply, said that the railway freight rebates on coal traffic were being concentrated on coal, coke, and patent fuel, exported or shipped as foreign bunkers, or as bunkers for fishing vessels, or delivered to iron or steel works. It followed that coal delivered to a coke oven was not subject to the rebate unless it formed part of an iron or steel works as defined in the scheme.

Gas Legislation.

The Burnley Corporation, which has a Special Order now proceeding through the House of Lords, has asked its M.P., the Right Hon. Arthur Henderson, to support the efforts of the National Gas Council in regard to general legislation.

MISCELLANEOUS NEWS.

COLOMBO GAS AND WATER COMPANY, LTD.

An Extraordinary General Meeting of the Colombo Gas and Water Company, Ltd., was held at the Company's Offices, 148, Gresham House, E.C. 2, on Monday, Dec. 3.

The CHAIRMAN (Mr. Strachan C. Clarke), who presided, said: A formal and detailed notice of this meeting having been sent to all the members, I will ask you to agree to take the same as read. It is a pleasure to your Board to call you together for the purpose set forth in the notice. The condition of the Company's business and finances at this juncture justify, in their opinion, the issue of one bonus share for every four ordinary shares now held, which follows on the issue in 1925 of one bonus share for every three. If you pass the resolution now to be submitted to you, two ordinary shares will have been added as bonuses to every three ordinary shares held prior to September, 1925.

I am pleased to say the Company's working results continue on the very satisfactory basis to which our Manager has raised them. We have just concluded a five-year contract with the Colombo municipality for gas lighting; fresh arrangements made here for coal, both delivered f.o.b. and for freight on same, having enabled us to offer attractive terms to the Council. The Company's sale of gas forty years ago was under 14 millions, ten years ago it was about 70 millions, and for last year 232 millions.

Our schemes for fitting-up consumers for cooking free of charge, and cheapening rates for the gas consumed in cookers, have produced good results; and the keenest attention is given to producing the most economical working and to all other matters affecting the Company's prosperity. Our capital expenditure on works bears favourable comparison with any other gas undertaking in the East. The importance of this point I need not emphasize.

I have the pleasure to move: "That it is desirable to capitalize the sum of £19,796 being part of the undivided profits of the Company standing to the credit of the Company's reserve account and accordingly that the same be distributed among the members registered at the closing of the share register of the Company on Nov. 22, 1928, holding the outstanding 79,185 ordinary shares of £1 each of the Company in proportion to the said ordinary shares held by them respectively free of income-tax on the footing that the said sum be not paid in cash but be applied in paying up in full 19,796 of the now existing unissued ordinary shares of £1 each of the Company: And that the Directors be and they are hereby authorized to distribute 19,796 of the said unissued ordinary shares credited as fully paid up by means of the profits so capitalized to and among the said members so registered as aforesaid so far as practical in proportion to the number of the said outstanding ordinary shares held by them respectively, that is to say, in the proportion of one unissued ordinary share for every four outstanding ordinary shares so held with power in case of any difficulty in such distribution in respect of fractions or otherwise to make such provision for meeting the same by in the case of the odd outstanding ordinary share a payment in cash and in all other cases the issue of fractional certificates or sale and distribution of the proceeds or otherwise as the Directors may think expedient. And that the said 19,796 shares so to be distributed as aforesaid are to rank for dividend as from Jan. 1, 1928, and carry the right to payment of an equivalent interim dividend to that already declared and paid for the half-year ended June 30 last in respect of the said outstanding 79,185 ordinary shares and in all other respects are to rank *pari passu* with and carry the same rights as the said outstanding 79,185 ordinary shares."

Mr. JOHN G. WARDROP seconded the motion, which was unanimously carried; and the proceedings then terminated.

REDHILL GAS COMPANY.

Co-Partners' Annual Meeting.

The Fifteenth Annual Meeting of the co-partners of the Redhill Gas Company was held at the Market Hall, Redhill, on Thursday evening, Nov. 29, when Mr. G. R. HUNT, J.P. (Chairman of the Committee of Management), presided.

The annual report stated that the number of co-partners registered on June 30 last was 168. The accounts for the year showed good progress; the cumulative amount of bonus and savings had advanced by £1655, making the sum total, as from the commencement in 1913, about £11,400. The sum credited last year for bonus and interest was £1326, showing an increase of £146. The savings account amounted to £329. The sum invested during the year in the Company's capital stock was £960, and the stock acquired under the scheme amounted to £7505 at June 30 last. Subsequent transfers had increased this total to £8755, the amount being divided amongst 141 co-partners holding, on an average, £62 per head.

AN INCREASED BONUS.

The CHAIRMAN said how very pleased the Directors were to see such a good attendance. They had extended to their neighbours from Dorking a very cordial welcome to their social gathering. They hoped soon to be able to add the names of these Dorking friends to their list of co-partners by virtue of the amalgamation, and trusted that they might in due time share that co-operative spirit and feeling of mutual interest, which had grown up amongst all ranks in the Redhill Company's service as the outcome of 15 years' working under the banner of co-partnership. Dealing with the report and statement of accounts, the Chairman said that the bonus for the last twelve months was in advance of that for the previous year, being at the rate of 5¼ p.ct. Those co-partners who had balances to their credit on withdrawal (or savings) account would do well to recognize the splendid opportunity now afforded for increasing their holding in the Company whilst the market price of the stock stood at an extremely moderate figure, having regard to the expansion of the undertaking and the excellent prospects of the industry generally.

In these days of keen competition in their business, he was sure that co-partnership well established and understood amongst all ranks of workers of the Company, was of the greatest assistance in maintaining and increasing their output and revenue. It undoubtedly fostered keenness and energy, inducing all to put their backs into the job, aiming at a reduced charge for gas, and greater prosperity for the undertaking. From the purely financial point of view, co-partnership had been defined as an arrangement whereby the worker was enabled to obtain a capital interest in the undertaking in which he was employed. Under co-partnership conditions workers might well give greater thought to the job in hand, even to such an extent as to notice from time to time improvements, the adoption of which might be capable of producing important results.

THE AMALGAMATION WITH DORKING.

As they were doubtless aware, under the agreed amalgamation between Redhill and Dorking, not only did the consumers secure immediate benefit, but the employees of the Dorking undertaking joined up with a business well established on co-partnership principles, and would share equally in the bonuses and general benefits which had been enjoyed by the gas workers at Redhill for many years. In conclusion, might he say that, given hearty co-operation all round, he felt convinced that their scheme would achieve results in the future far greater than any already recorded. He had pleasure in moving that the Committee's report and the statement of the Trustees' accounts for the twelve months ended June 30 last be approved and adopted.

Mr. W. LOFTS seconded the motion, which was carried.

Mr. W. H. BENNETT, Vice-Chairman, said that provision had been made in some works for receiving suggestions from employees. Soon after co-partnership was started in the Company he suggested to the Committee that they should have suggestion boxes in their own works, but it was felt by the Committee at that time that, perhaps, men in one department might feel that others were trying to interfere with their work by suggesting better methods by which that work might be done; and that view having been expressed, he dropped the idea. He felt that to-day circumstances had altered so much that the Company might well adopt this idea of placing boxes in the works in which suggestions from members of the staff might be placed as to better methods of working or, in fact, any idea that might occur to them which would be of benefit to the Company.

Mr. W. LEES STENNING, J.P., Chairman of the Company, in proposing a vote of thanks to the Chairman and officials, said that he congratulated their Chairman upon having held that position during the 15 years the scheme had been in existence. They all esteemed him, and they knew he was only too pleased to give his advice, and more than advice, to anyone who needed it. The work grew; they had passed the £10,000 mark, and there had been between 20 and 30 co-partners joining them during the past year. They owed a debt of gratitude to all the officials for the work they did for them.

Mr. A. L. BROOKER seconded the motion.

The CHAIRMAN briefly responded, and the evening closed with a musical entertainment.

GLASGOW'S MUNICIPAL UNDERTAKINGS.

In a recently published booklet by the Glasgow Corporation the various municipal undertakings and enterprises are fully dealt with, and there is a comprehensive section on the history and progress of the gas industry in that city.

Gas was introduced into Glasgow, it states, by a private company in the year 1818. In 1869 the Corporation obtained power, by Act of Parliament, to acquire the undertakings of the two local gas companies then supplying gas within the city and surrounding neighbourhood, and to construct new works. The amount of gas manufactured per year by the two companies at that time was 1,206,921,000 c.ft., and the rate charged was 4s. 7d. per 1000 c.ft. During subsequent years the Corporation bought up the undertakings of several gas companies in the immediate neighbourhood; and, as a result, the Corporation now supply gas over an area of about 100 square miles. There are 1218 miles of gas distributing mains, and the gas is supplied at city prices throughout the whole area annexed thereto in 1925.

There are four gas-works belonging to the Corporation, situated at Provan, Dawsholm, Tradeston, and Dalmarnock. Provan is the largest of these works, and is equipped with an installation of vertical retorts, inaugurated in 1922, which is capable of producing 18 million c.ft. of gas per day. The total manufacturing capacity of the four works is 50 million c.ft. a day. The amount of gas manufactured during the year ended May 31, 1927, at the four works exceeded 9000 million c.ft., for the production of which 661,042 tons of coal were used.

The rates charged for private lighting purposes range from 3s. 2d. to 5s. 2d. per 1000 c.ft., and for power and manufacturing purposes from 5s. 2d. to 1s. 11½d. per 1000 c.ft. The rate for public lighting

in the city supply area is 2s. to 4s. per 1000 c.ft. The revenue from the sale of gas in the extended city for the year ended May 31, 1927, was £1,562,025, and in the adjoining burghs and districts £180,528—a total of £1,742,553.

Chemical works belonging to and managed by the Department adjoin each gas-works. At these the tar and ammoniacal liquor are treated for the production of pitch, sulphate of ammonia, naphtha, benzole, &c. The capital expenditure incurred by the Corporation in carrying out and extending the gas undertaking for the benefit not only of the citizens of Glasgow, but also of the inhabitants of the districts adjacent to the city, is now £7,952,662.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

There has been a satisfactory week's trading in this market. Better weather has considerably improved the tonnage position, and loading berths are now being fully occupied. The eagerness to complete shipments before the year-end holidays, which is customary at this season, is decidedly more pronounced than at this time last year; and this may be regarded as a healthy sign. Provided that there is no serious interference with the movements of shipping, such as was experienced last month, collieries should be able to work well for the rest of the year, and the market may be expected to firm up.

Gas coals have shown an improving tendency, and though nominal quotations remain practically unchanged, the position is steadier at 15s. to 15s. 3d. f.o.b. for Wear Specials, 14s. 9d. for best qualities, and 13s. to 13s. 6d. for seconds. Unscreened coking are still quoted at 13s. to 13s. 6d., and there does not appear to be much improvement in the demand. Durham bunker makes show a steadier tone. Best qualities are well sold, and quote up to 14s. 3d. Seconds and others are still plentiful at 13s. to 13s. 3d. Northumberland steams are well sold to the end of the year, and best screened qualities quote 14s. to 14s. 3d. Smalls are a difficult market, but in some cases these show slight improvement.

Gas coke is slow, and the demand remains disappointing. The quotation is rather lower at 18s. 6d. to 19s. 6d. f.o.b. for shipment.

YORKSHIRE AND LANCASHIRE.

Gas coals are in request in view of the probability of a long stoppage at Christmas. At the majority of the pits no work will be done from Dec. 24 until next month.

Industrial coal has occupied attention during the past week on account of renewals of contracts, and washed singles and doubles have appreciated in value. In some instances, collieries have revised their prices. Some consumers appear to have delayed purchasing their forward requirements in order to ascertain if they were entitled to any benefit under the new arrangement of rates, only to find that outside the iron and steel trades there will be no alteration.

The export market is unchanged, with hards practically unobtainable except where they were purchased some time ago.

The demand for domestic coal does not show any material increase. Some of the better grades are more popular than they were some time ago, although secondary qualities are still chiefly in request.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports:

South Yorkshire—Hards, Association, bunkers 19s. 3d. to 19s. 6d., export 16s. to 16s. 6d.; screened gas coal, export 15s. 6d. to 16s. 6d.; washed trebles, export 16s.; washed doubles, bunkers 17s. to 17s. 3d., export 15s. to 15s. 3d.; washed singles, export 14s. to 14s. 3d.; washed smalls, bunkers 13s. 9d., export 10s. 9d. to 11s.; rough slack, bunkers 12s. 6d. to 13s., export 8s. 6d. to 9s.; smithy peas, export 16s. 6d. to 17s. 6d. per ton.

West Yorkshire—Hartley's (f.o.b. Goole), bunkers 16s. 9d. to 17s. 3d., export 14s. to 15s.; screened gas coal, export 14s. to 15s.; washed trebles, export 15s. 6d. to 16s.; washed doubles, export 14s. to 14s. 6d.; washed singles, export 13s. to 13s. 3d.; washed smalls, bunkers 13s. 3d., export 10s. to 10s. 6d.; unwashed trebles, export 14s. 6d. to 15s.; unwashed doubles, export 11s. 6d. to 12s.; rough slack, export 8s. 9d. to 9s. 3d.; coking smalls, export 8s. 6d. to 9s. 6d. per ton.

Derbyshire and Nottinghamshire—Top hards, bunkers 19s. 3d. to 19s. 6d., export 16s. to 16s. 6d.; cobbles, export 15s. 6d. to 16s.; washed trebles, export 15s. 6d. to 16s.; washed doubles, export 13s. 6d. to 14s. 3d.; washed singles, export 13s. to 13s. 6d.; washed smalls, bunkers 13s. 6d. to 13s. 9d., export 10s. 6d.; unwashed doubles, export 12s. to 13s.; rough slack, bunkers 12s. 6d. to 13s., export 8s. 6d. to 9s. per ton.

Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, bunkers 17s. to 18s., export 13s.; gas coke, export 21s. to 22s. 6d.; furnace coke, export 19s. to 19s. 6d.; washed steam, Goole (West Yorks.), bunkers 16s. to 16s. 6d.; Hull (West Yorks.), bunkers 17s.; Hull (South Yorks.), bunkers 17s., export 14s. 6d. to 15s. per ton.

MIDLANDS.

There is little measurable increase in the volume of demand for house coals. In some respects, notably in the higher qualities, collieries have difficulty in disposing of their output. The fact that there is no longer a plethora of slacks is significant. Apart from lighting and heating services there has been no call for increased supplies. The tendency has been rather the other way in the industrial market. Traders attribute the better equilibrium principally to the unusually small output of domestic fuel for this season of the year, and the corresponding diminution of the supplies of slack. Prices show only minor fluctuations.

There are hopeful anticipations of continued expansion in the export trade. Many of the coalowners in this district feel strongly, however, that if reorganization is to be fully effectual a common basis of action must be adopted throughout the coalfields.

At the time of writing no clear policy has been evolved with regard to the rebate on fuel supplied to the iron and steel works. Though there is discordance there is no dislocation worth mentioning. New commitments are delayed pending the clarifying of the position, and as far as current business is concerned reservations are made respecting the rebate. It is stated that several collieries have declared to pay freights on contracts now running in order to get control of the rebate. Blast-furnacemen reply that they will deduct the rebate when the accounts are presented. The merchants are beset on both sides. A number of leading merchants announce that they are only wishful that such rebates as come into their hands should reach the industrialists for whose relief they are intended. For themselves they disclaim any right.

PRICE OF GAS IN GLASGOW.

The possibility that the Glasgow Gas Department will be able to reduce prices early in the new year is being contemplated by the Gas Committee of the Corporation. The Committee, at a recent meeting, discussed the situation, and gave instructions to the General Manager, Mr. J. W. McLusky, to prepare a statement showing the financial results of the half-year ended Nov. 30. This report, it is expected, will come before the Gas Committee at their next meeting towards the end of December; and should it prove satisfactory—and the anticipations are that it will—it is probable that a reduction in charges will be authorized immediately.

The present price of gas is 3s. 8d. per 1000 c.ft., or 9·362d. per therm, which shows a very substantial decrease from the charge current a little over a year ago. It may be recalled that the Department had the large deficit of £940,336 at the beginning of the financial year 1926-27, due, of course, to the coal strike. Since that time a good recovery has been made, and at the commencement of the financial year six months ago there was a surplus of £628,083. The price of gas has been reduced during this favourable period from 5s. 2d. to 3s. 8d. per 1000 c.ft.

TRADE NOTES.

Steel Gas Pipes.

Messrs. Stewarts & Lloyds, Ltd., have just published their monthly stock list for December, containing details of the various types of steel gas pipes they manufacture.

Waterless Gasholder for Northwich.

The Northwich Gas Company have placed a contract for a waterless gasholder of 500,000 c.ft. capacity, to be erected upon an elevated foundation. The contractors for the work are Messrs. Clayton, Son, & Co., Ltd., of Leeds.

Blackman Gas Pressure Plant.

The Blackman Export Company, Ltd., of Euston Road, N.W. 1, Air and Gas Engineers, have produced a booklet dealing with their gas pressure plant for town supply, producer gas, water gas, &c. The Company guarantee to repair without charge all parts of their goods which, within one year (or six months if in continuous use), are proved to have given way owing to faulty material or workmanship, or to supply parts for replacement free.

Air Heaters, Portable Forges, and Blast Fans.

Messrs. James Keith & Blackman Company, Ltd., of Farringdon Avenue, E.C. 4, have published pamphlets dealing with their steel tube air heaters, smiths' hearths, portable forges, blast fans, &c. To meet all requirements, the sections of the return tube heaters are made in many sizes in each of the two designs, called the "independent" and "flanged" header type respectively. Both designs lend themselves to automatic temperature control by means of thermostats.

The "Windsor Rotostat."

Messrs. Battershell Bros., of Blackfriars Road, S.E. 1, are placing on the market their new "Windsor Rotostat," which, it is claimed, thoroughly cleanses and purifies the fumes that issue from the oven of a gas cooker, and completely extracts all smoke, dirt, grease, and vapour. The makers claim that, in addition to preventing any greasy deposits on the walls or ceiling of the kitchen, it helps to retain the heat in the oven, and so effects economy in gas consumption. The device is simple, and can be fixed to any type of gas oven.

Detrick Arch Company, Ltd.

The Detrick Arch Company, Ltd., announce that they have taken over from the Underfeed Stoker Company, Ltd., all rights for the design, manufacture, and sale of all flat suspended arches, roofs, and furnace walls constructed under the patent rights of M. H. Detrick Company in Great Britain and the Colonies (excluding Canada). They have also acquired the rights of design, manufacture, and sale of "Beco" boiler baffles for the same countries. The operations of the Company will be under the management of Mr. J. K. Mann, formerly with the M. H. Detrick Company, of Chicago. The manufacture of all Detrick productions is entirely British, and the sales during the current year have increased by 300 p.ct.

CONTRACTS OPEN.

Gas Compressors.

The Belfast Gas Committee invite tenders for the supply and erection of two gas compressing sets. [See advert. on p. 751.]

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 10.

The market for tar products is steady.
Pitch is unchanged at about 40s. per ton.
Creosote is about 7d. per gallon.
There is a fair demand for toluole; 90 p.ct. being 1s. 9d. to 1s. 10d. per gallon, pure 2s. to 2s. 1d. per gallon.
Pure benzole is about 1s. 9d. per gallon.
Solvent naphtha, 95/160, 1s. 6½d. to 1s. 7d. per gallon.
Pyridine is about 4s. 6d. per gallon.

Tar Products in the Provinces.

Dec. 10.

There is nothing of interest to report in the markets for tar products, which are very dull indeed with the exception of water-white products. The latter are still very firm, and manufacturers have refused offers for benzole and solvent naphtha for delivery all over next year.

In pitch there is little or no business doing. Continental quotations to-day are on the basis of 36s. 6d. to 37s. 6d. per ton f.o.b.

Creosote is dull, and practically no business has been done. Shipments, however, continue satisfactory.

The market for crude carbolic acid remains steady, and there is no alteration in the price of crystals.

In cresylic acid some business has been done in the better grades; but the lower qualities are still very difficult of sale.

The average prices of gas-works products during the week were: Gas-works tar, 27s. 3d. to 32s. 3d. Pitch—East Coast, 36s. 6d. to 37s. 6d. f.o.b. West Coast—Manchester, 31s. 6d. to 32s. 6d.; Liverpool, 33s. 6d. to 34s. 6d.; Clyde, 33s. 6d. to 34s. 6d. Toluole, naked, North, 1s. 5d. to 1s. 6d. nominal. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 1¼d. to 1s. 2d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid, 5¼d. to 5⅝d.; salty, 5⅜d. to 5⅝d.; Scotland, 5⅜d. to 5⅝d. Heavy oils, in bulk, North, 8¼d. to 8¼d. Carbolic acid, 60 p.ct., 1s. 11d. to 2s. prompt. Naphthalene, £13 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.		s. d.	
Crude benzole . . .	0 10	to	0 10½	per gallon at works
Motor ,, . . .	1 4	,,	1 4½	,, ,,
90 p.ct. ,, . . .	1 7	,,	1 8	,, ,, ,,
Pure ,, . . .	1 10	,,	1 11	,, ,, ,,

The Half-Year's Progress at Loughborough.—At a meeting of the Loughborough Town Council recently, the statement of accounts of the gas undertaking for the half-year ended Sept. 30 showed a total expenditure of £16,469, and a revenue by sales of gas and residual products of £21,715. The gross profit was £102 less than the corresponding period last year, though the expenditure had been slightly reduced.

Accident at the Windsor Gas-Works.—An explosion occurred at these works on Saturday, Dec. 1, while testing a new booster fan. The General Manager, Mr. H. Buckley, and three men—G. Higley, H. Gray, and Whitcher—were burned on the face and hands. The injured were immediately sent to hospital, and are progressing satisfactorily. The exact cause of the explosion is not known; but apart from a slight bulge in the back wall of the house, no damage to plant was done.

Let Gas Help this Christmas.—The Christmas number of "A Thousand-and-One Uses for Gas" contains some useful hints regarding the value of gas at this season. There is a preface by Mrs. Robert Ascroft, the Editor of "Modern Home," and all the other contributions are by experts. The cooking of a full Christmas dinner is explained by well-known chefs, and recipes are given for various fancy dishes. Included also are suggestions for useful presents connected with the use of gas.

Proposed Extensions at Walsall.—The Walsall Corporation Gas Committee propose to open a new branch showroom at Bloxwich, and to purchase a freehold shop and dwelling-house in High Street, together with buildings at the rear. Other expenditure proposed by the Committee includes £3990 on the laying of mains along the new section of the Ring Road between Birmingham Road and West Bromwich Road, and £2808 on the improvement of the gas purification and tar extraction plant.

Accident at the Shoreditch Works of the Gas Light and Coke Company.—A report appeared in the London Press last week (couched in somewhat alarming tones) concerning "an explosion at the Shoreditch Works of the Gas Light and Coke Company." On inquiry of the Company we learn that a new unit of carburetted water gas plant of the latest type, with boiler generator and waste-heat boiler, and equipped for automatic operation, was being started up for the first time by the builders. The direct and boiler stack valves were both in use, and probably a pocket of blast air-gas mixture collected in the boiler. The generator was being coked-up at the time of the explosion, and had been open some two minutes before the flash occurred. The back flame from the charging door burnt and scorched the two men coking-up, and one was detained a day in hospital. The material damage was confined to the plating of the dust catcher over the boiler stack, and to the displacement of some glass and slates in the immediate vicinity of the plant.

International Union of Local Authorities.—The Fourth International Congress of Local Authorities will be held in Seville in March, 1929, under the patronage of His Majesty the King of Spain and the Spanish Government, and under the auspices of the Municipalities of Seville and Barcelona. A series of visits will be paid both before and after the Congress to various Spanish towns which have expressed a desire to receive the delegates. Thirty countries all over the world are actually represented in the International Union of Local Authorities, and a general Committee for England and Wales is established in London under the presidency of the Lord Mayor of London. The Secretary is Mr. G. Montagu Harris.

Gas Exhibition at Buxton.—A week's gas exhibition and practical cookery demonstrations, organized by the Buxton Corporation Gas Department, was brought to a successful close on Saturday night, Dec. 1, at the Gas Service Rooms, Higher Buxton, when the Mayoress (Mrs. S. L. Pettitt) distributed the awards, including a gas fire and a set of gas irons, gained in a bread-baking competition. Miss Tuxford was the lecturer at the cookery demonstrations, and the attendance, which averaged nearly 200 a day, was most encouraging. Mr. F. G. Shaw, the Borough Gas Engineer, in introducing the Mayoress on the opening day of the exhibition, said that since the last series of cookery demonstrations held in Buxton there had been a reduction in the price of gas. The Mayoress, in declaring the exhibition open, paid tribute to the energy and enterprise of Mr. Shaw.

Renewal of Mains at Birmingham.—The Birmingham Gas Committee, in a report to the City Council, recalled the fact that the capital on new mains and services to the extent of £189,000 was authorized by the Council in January, 1926. It was anticipated that the balance of that sum would be expended by Christmas. The expenditure on new mains and services continued to be very heavy in consequence of the activity existing in the building trades, and the development of housing schemes in the Department's area of supply. Further, a considerable sum was being spent annually by the undertaking in improving the existing supply of gas throughout the district. In order to make provision for the supply of mains and services to March 31, 1931, it was anticipated that a further £125,000 would be required. The Gas Committee, therefore, asked for authority to borrow that sum.

Fire Protection.—A conference arranged by the Association of Liquid Chemical Fire Extinguisher Manufacturers took place on Tuesday, Dec. 4, at the Institution of Mechanical Engineers. The chair was taken by Mr. A. E. Wiseman (the Pyrene Company, Ltd.), who was supported by Mr. S. G. Gamble, and by the following members of the Council of the Association: Messrs. J. W. Blackman (the Valor Company, Ltd.), A. W. Cook (Minimax, Ltd.), Leonard Jones (Samuel Jones & Co., Ltd.), W. E. Ashley (J. Blakeborough & Sons, Ltd.), and C. T. Parfitt (Moneys Patents, Ltd.). Mr. Wiseman, in opening the conference, welcomed a large number of representatives from fire brigades, municipal authorities, important manufacturing concerns, and others interested in practical fire protection. He stated that this was the first meeting of its kind that had ever been held in this country. The Council of the Association felt that nothing but good could come from the makers of fire appliances meeting the actual users, with a view to a mutual understanding of their respective problems. During the first nine months of this year, the fire losses in this country amounted to about £8,000,000. This represented an increase of about £1,000,000 over the first nine months of 1926, and nearly £3,000,000 during the similar period in 1927. The manufacturers of fire appliances were doing a vast amount of research work in an endeavour to supply equipment to combat this menace to the prosperity of industry; and the conference had been organized with a view to co-operative action between themselves and the actual users of their appliances.

Street lighting at Darwen by gas last year cost £2296, and by electricity £1241; the average cost per gas lamp being £2 5s. 7d. and per electric lamp £7 4s. 4d.

The Ballymena Council have decided to apply for an Electricity Special Order, and have appointed Mr. Cyril Surman, the Gas Manager, to draw up a report on the prospects of electric lighting.

The Blackburn Gas Committee have approved a supplementary estimate from the Gas Engineer for £10,000 for the renewal of gas mains and services, which sum is to be paid out of the revenue.

The Ballymena Town Hall, which was formally opened a few days previously by the Governor of Ulster, was the scene of a gas explosion, as a result of which several windows were shattered, and some damage was done to woodwork.

Deputations from various municipalities have paid visits of inspection to the Blackburn Corporation gas showrooms, distribution stores, and works at Greenbank within the last few weeks, and all have expressed admiration of the general equipment and efficiency of the Department. Last week representatives were received from Chorley, Stirling, and Oldham.

The Chairman of the Clayton-le-Moors Council, at a meeting on Dec. 6, reported that there had been several complaints about the quality of gas. He understood that the Manager of the Accrington District Gas Board was doing all he could to remedy the defect, which was caused by the turn-over of supply from their own gas-works to the plant at the Altham Colliery.

At the last meeting of the Cheslyn Hay Council, the Directors of the Cannock and District Gas Company were asked to reconsider the Council's request for an alteration in the lighting arrangements in the village streets. It was reported, however, that the Directors of the Company had already reconsidered the question, but could not alter their decision. The Council, therefore, authorized the signing of the agreement for this year, but made it clear that in future years, if gas was used, they would have a voice in the wording of the agreement.

STOCK MARKET REPORT.

BUSINESS on the Stock Exchange continued on the quiet side last week. There were further liquidations; and the disturbing effect of the King's illness was accentuated by the seasonal reduction in the number of transactions. While prices in the gilt-edged stocks remained firm, the market seemed more sensitive to outside influences. A satisfactory feature, however, was a revival of interest in Home Rails.

The Gas Market was again an exception to the general rule; and it will be seen from the daily summary below that recorded transactions were exceedingly heavy. Lea Bridge 5 p.ct. ordinary made another spurt, and the quotation is now 5 points higher at 115-120. There is no remarkable feature in the other variations, but the most important is a fall of 1s., to 22s.-24s., in the Primitiva ordinary.

The following transactions were recorded during the week:

On Monday, Alliance and Dublin 98, 98¼, Bournemouth "B" 12½, Colombo 7 p.ct. pref. 22s. 1½d., Commercial 3 p.ct. deb. 59½, Continental Union 37¼, Croydon sliding-scale 111½, 112½, max. div. 85, Gas Light and Coke 18s. 7½d., 18s. 9d., 18s. 10d., 18s. 10½d., 19s., 4 p.ct. pref. 79¾, Imperial Continental 167½, Maidstone 5 p.ct. 122, 3 p.ct. deb. 56, Metropolitan (of Melbourne) 5½ p.ct. deb. 100½, 101, Montevideo 96, 96½, Primitiva 23s. 6d., 23s. 7½d., South Metropolitan 107½, 108, Tottenham "B" 101⅞, 102, Wandsworth Wimbledon stock 109½, 110 3/16. Supplementary prices, Bournemouth new 6 p.ct. pref. 11 9/16 (issued at £11 5s., £6 5s. paid, 6½, 6 9/16), Liverpool 5 p.ct. 90¼.

On Tuesday, Bournemouth "B" 12 11/16, Continental Union 38, 38½, Croydon sliding-scale 112, 112½, max. div. 86, European 8½, Gas Light and Coke 18s. 7½d., 18s. 9d., 18s. 10½d., 19s., 4 p.ct. pref. 79, 79¼, 79⅞, 80, 3 p.ct. deb. 60⅞, 61, 5 p.ct. deb. 100⅜, Imperial Continental 166½, 167½, 167¾, Maidstone 5 p.ct. 124½, Primitiva 23s. 3d., 23s. 9d., South Metropolitan 107, 107⅛, 107⅜, 3 p.ct. deb. 60¼, 61, Tottenham "B" 102½, 102¾. Supplementary prices, Liverpool 5 p.ct. 90¼, 90½, 90⅝, Metropolitan (Melbourne) 9⅜, Reading 5 p.ct. max. 83½, 84.

On Wednesday, Colonial 25s., 8 p.ct. pref. 21s. 9d., Commercial 100, 100½, Continental Union 38⅜, 7 p.ct. pref. 94, Gas Light and Coke 18s. 9d., 18s. 10d., 18s. 10½d., 18s. 11¼d., 19s., 4 p.ct. pref. 79, 5 p.ct. deb. 100¼, Imperial Continental 168½, 169, Portsmouth 4 p.ct. 102½, 5 p.ct. 81, Primitiva 23s. 3d., 23s. 4½d., 23s. 6d., South Metropolitan 107⅜, 108. Supplementary prices, Brighton and Hove 7 p.ct. deb. 102, Croydon 7½ p.ct. pref. 102, Eastbourne 3½ p.ct. 104½, 105, Lea Bridge District 7 p.ct. deb. 101, Metropolitan (of Melbourne) 9 1/16.

On Thursday, Alliance and Dublin 98⅜, British 116½, 117, Colonial 24s. 6d., 25s., Commercial 100¼, 100½, Continental Union 39, 7 p.ct. pref. 93½, Croydon sliding-scale 111½, Gas Light and Coke 18s. 9d., 18s. 11¼d., 19s., Maidstone 3 p.ct. deb. 57, Primitiva 23s., South Metropolitan 107¼, 107⅜, 6½ p.ct. deb. 101¼, South Suburban 5 p.ct. 110, Swansea 6½ p.ct. deb. 101¾, 102½, Tottenham "B" 102. Supplementary prices, British, Hull 3½ p.ct. deb. 62, Gas Light and Coke 5 p.ct. deb. 100¼, Pinner 7 p.ct. deb. 101, Rochester, Chatham 6 p.ct. pref. 100½, South Suburban 5 p.ct. deb. 100.

On Friday, Alliance and Dublin 4 p.ct. deb. 65, Continental Union 38¼, 7 p.ct. pref. 93½, 94½, Gas Light and Coke 18s. 9d., 18s. 10½d., 19s., 3½ p.ct. 63½, 3 p.ct. deb. 60½, Imperial Continental 168½, 169, Lea Bridge 5 p.ct. 117, Liverpool 7 p.ct. pref. 102⅜, Maidstone 5 p.ct. 123½, 124½, Primitiva 22s. 9d., 23s., 23s. 1½d., 23s. 6d., 4 p.ct. con. deb. 79, South Metropolitan 107¼, 107⅜, Tottenham "B" 102¾. Supplementary prices, British, Norwich 3 p.ct. deb. 54, Gas Light and Coke 5 p.ct. deb. 100¼, Liverpool 5 p.ct. 91¼.

Money was plentiful in the short loan market at the end of the week, and fresh accommodation for the night was easily obtainable at 3 p.ct. down to 2½ p.ct.; old loans were being usually renewed at the former rate. The average rate at which Treasury Bill allotments were made was 1s. 4·24d. p.ct. above that of the previous week at £4 6s. 9·47d. p.ct., and discount rates hardened in consequence.

The movements in the Foreign Exchange market were mostly against this country. Belgas closed at 34.89; Dutch florins at 12.07⅜; and Italian lire at 92.63½. German marks were cheaper at 20.35¾; Sterling on New York continued at 4.85 1/16; French francs at 124.17½; and pesetas at 30.03.

Silver was easier in tendency on Chinese sales, the price declining to 26 1/16d. per oz.; while Gold remained nominally at 84s. 11½d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21, 1927. The Banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2½ p.ct. at call and 2¾ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Dec. 7.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Aug. 30	5	5	Aldershot 5 p.c. max. C.	72—77	..	..
412,992	,,	,,	4	4	Do. 4 p.c. Pref.	69—72	..	..
1,651,868	,,	Sept. 27	7	7½	Alliance & Dublin Ord.	96—99	..	98—98⅞
374,000	,,	July 12	4	4	Do. 4 p.c. Deb.	63—66	..	65
522,854	,,	Aug. 30	7	7	Barnet Ord. 7 p.c.	114—117	..	..
800,000	1	Oct. 11	1/1‡	1/4‡	Bombay, Ltd.	20/—22/-	..	..
170,000	10	Aug. 30	8½	8½	Bournemouth 5 p.c.	12½—13½	..	..
600,050	10	,,	7	7	Do. B 7 p.c.	12½—12¾	..	12⅝—12 11/16
575,000	10	,,	6	6	Do. Pref. 6 p.c.	11—11⅛	..	..
50,000	Stk.	July 12	3	3	Do. 3 p.c. Deb.	56—59	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	75—78	..	..
357,300	,,	Aug. 30	7½	7½	Brighton & Hove 6 p.c. Con.	115—118	..	..
341,880	,,	,,	6¾	6¾	Do. 5 p.c. Con.	101—104	..	..
1,287,500	,,	July 26	5	5	Bristol 5 p.c. max.	92—93a	+½	..
885,000	,,	Sept. 27	7	8	British Ord.	114—117	..	116¼—117
100,000	,,	June 28	7	7	Do. 7 p.c. Pref.	114—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	74—77	..	..
300,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	95—98	..	..
100,000	10	Dec. 6	8	6	Cape Town, Ltd.	7⅞—8⅛*	−¼	..
150,000	10	Oct. 25	4½	4½	Do. 4½ p.c. Pref.	6⅞—7⅛	..	..
150,000	Stk.	June 28	4½	4½	Do. 4½ p.c. Deb.	73—78	..	..
626,380	,,	July 26	6	6	Cardiff Con. Ord.	97—100	..	..
287,360	,,	June 28	7½	7½	Do. 7½ p.c. Red. Deb.	100—103	..	..
157,150	,,	Aug. 16	6½	5	Chester 5 p.c. Ord.	88—93b	..	..
79,185	1	Oct. 11	12/-	12/-	Colombo Ltd. Ord.	41/— 43/-	..	..
24,495	1	,,	1/4‡	1/4‡	Do. 7 p.c. Pref.	21-/—23 -	+-/6	22/1½
375,402	1	Oct. 11	1/9‡	1/9‡	Colonial Gas Assn. Ld. Ord.	24/—26/-	+-/6	24/6—25/-
187,848	1	,,	1/7‡	1/7‡	Do. 8 p.c. Pref.	21/—23/-	..	21/9
2,073,280	Stk.	July 26	7	5	Commercial Ord.	98—101	..	100—100½
475,000	,,	June 14	8	8	Do 8 p.c. Deb.	57—60	..	59½
800,000	,,	Sept. 27	11	11	Continental Union, Ltd.	37—40	..	37½—39
200,000	,,	,,	7	7	Do. 7 p.c. Pref.	90—95	..	93¾—94½
787,560	,,	Aug. 16	7	7	Croydon sliding scale	110—113	..	111½—112½
403,100	,,	,,	5	5	Do. max. div.	84—87	..	85—86
492,270	,,	Aug. 16	10	7	Derby Con.	115—120e	..	..
55,000	,,	June 28	4	4	Do. Deb.	71—78e	..	..
999,000	,,	Aug. 30	5	5	East Hull Ord. 5 p.c.	75—78	..	..
1,002,180	10	Sept. 13	16	14	European, Ltd.	8—9	..	8½
13,703,480	Stk.	July 26	5/1‡	5‡	Gas Light & Coke 4 p.c. Ord.	18/7⅛—19/1½f	−-/1½	18/7⅛—19/-
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	62⅛—64½	..	63½
4,187,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	77—80	..	79—80
5,802,620	,,	* June 14	3	3	Do. 3 p.c. Con. Deb.	60—62	..	60½—61
181,315	,,	,,	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	104—107	..	..
1,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	100—102	..	100½—100⅝
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Aug. 30	6⅞	7	Hastings & St L. 5 p.c. Conv	95—100	..	..
258,740	,,	,,	5⅞	5⅞	Do. 3½ p.c. Conv.	75—80	..	..
70,000	10	Oct. 11	†10	†10	Hongkong & China, Ltd.	13—14	..	..
178,200	Stk.	Aug. 30	5	5½	Hornsey Con. 3½ p.c.	88—91	..	..
1,976,000	,,	Nov. 8	10	10	Imperial Continental Cap.	167—170	..	166½—169
328,130	,,	Aug. 16	8½	8½	Do. 8½ p.c. Red. Deb.	67—69	..	..
335,342	,,	Aug. 16	7	7½	Lea Bridge 5 p.c. Ord.	115—120	+5	117
2,145,907	,,	Aug. 16	5½	5½	Liverpool 5 p.c. Ord.	90⅜—91½b	+¼	..
600,000	,,	Sept 27	7	7	Do. 7 p.c. Red. Pref.	101—102b	..	..
165,786	,,	Aug. 16	8	9	Maidstone 5 p.c. Cap.	120—125	..	122—124½
63,480	,,	June 14	3	3	Do. 3 p.c. Deb.	55—58	..	56—57
75,000	5	Dec. 6	18	18	Malta & Mediterranean	5½—5⅝*	−¼	..
541,920	Stk.	Nov. 22	17	15	Montevideo, Ltd.	95—97*	..	96—96½
2,081,816	,,	Aug. 16	5	6	Newcastle & Gateshead Con.	16/3—16/9d f	+-/1½	..
360,929	,,	,,	4	4	Do. 4 p.c. Pref.	71½—72½d	+1½	..
691,705	,,	June 28	8½	8A	Do. 8½ p.c. Deb.	69½—70½d	..	..
181,780	,,	Aug 30	6/18/0	7/1 0	North Middlesex 6 p.c. Con.	102—107	..	..
300,000	,,	Nov. 22	7	9	Oriental, Ltd.	112—115*	..	..
188,120	,,	June 28	7½	7½	Plym'th & Ston'house 5 p.c.	110—113	..	..
414,500	,,	Aug. 30	7⅜	7⅜	Portsm'th Con. Stk. 4 p.c. Red.	101—104	..	102½
236,782	,,	,,	5	5	Do. 5 p.c. max.	79—82	..	81
2,334,464	1	—	—	—	Primitiva Ord.	22/—24/-	−1/-	22/9—23/9
244,500	100	Dec. 3	4	4	Do. 4 p.c. Red. Deb.	91—94*	..	..
695,009	Stk.	July 26	4	4	Do. 4 p.c. Red. Deb. 1911	78—80	..	..
416,345	,,	June 28	4	4	Do. 4 p.c. Cons. Deb.	78—80	..	79
150,000	10	Sept 27	6	6	San Paulo 6 p.c. Pref.	83—88	..	..
270,000	Stk.	Aug. 30	6	6½	Sheffield A	104—105e	..	..
419,988	,,	,,	6	6½	Do. B	104—105e	..	..
1,047,000	,,	,,	6	6½	Do. C	104—105e	..	..
90,000	10	June 14	3	14	South African	4—6	..	..
6,609,895	Stk.	July 26	7½	5	South Met. Ord.	106½—108½	..	107—108
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	110—113	..	..
1,895,445	,,	July 12	8	8	Do. 8 p.c. Deb.	59—61	..	60½—61
784,000	,,	Sept 13	6½	6½	Do. 6½ p.c. Red. Db.	100—102	..	101½
91,500	,,	Aug. 16	8½	8½	South Shields Con.	109—110d	..	..
1,248,795	,,	July 26	6½	6½	South Suburban Ord. 5 p.c.	108—111	..	110
868,887	,,	June 28	5	5	Do. 5 p.c. Deb.	98—101	..	..
647,740	,,	Aug. 30	5	5	South'mpton Ord. 5 p.c. max.	77—79	..	..
131,275	,,	June 28	4	4	Do. 4 p.c. Deb.	72—75	..	..
350,000	,,	Aug. 30	7	7	Swansea 7 p.c. Red. Pref.	101—103	..	..
300,000	,,	June 28	6½	6½	Do. 6½ p.c. Red. Deb.	101—103	..	101¾—102½
120,000	,,	July 26	7½	8	Tottenham District A 5 p.c.	117—122	..	..
682,275	,,	,,	6½	6½	Do. B 5½ p.c.	100—103	..	101½—102½
150,060	,,	,,	5½	5½	Do. 5½ p.c. Pref.	96—99	..	..
181,255	,,	Dec. 6	4	4	Do. 4 p.c. Deb.	75—78*	−1	..
289,094	,,	Aug. 30	6 5/16	6⅞	Uxbridge, Maidenhead, & Wycombe 5 p.c.	93—98	..	..
99,880	,,	,,	5	5	Do. 5 p.c. pref.	87—92	..	..
80,000	,,	July 12	8½	8½	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	130—135	..	..
256,636	,,	,,	7	7½	Do. B 5½ p.c.	118—118	..	..
432,555	,,	,,	5/19/0	6½	Do. C and New	99—104	..	..
352,000	,,	,,	6⅞	6⅞	Do. Wimbledon 5 p.c.	107—119	..	109½—110 7/16
98,000	,,	,,	7½	7½	Do. Epsom 5 p.c.	115—120	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref	88—91	..	..
98,416	,,	June 28	8	8	Do. 8 p.c. Deb.	57 60	..	..
384,748	,,	,,	4	4	Do. 4 p.c. Deb.	76—79	..	..
207,500	,,	,,	5	5	Do. 5 p.c. Deb.	98—100	..	..

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of Stock. * Ex. div. † Paid free of income-tax. ‡ For year.

GAUGES

of ALL descriptions

INDICATORS and RECORDERS

DEAD-BEAT INDICATORS
Simmance Patent.

(can now be had with vertical or horizontal edgewise scale).

KING'S GAUGES

WATER COLUMN GAUGES
SINGLE-TUBE
U-TUBE
DOUBLE TUBE
INCLINED-TUBE

also for mercury.

DEAD-BEAT RECORDERS
Simmance Patent.

PRECISION REGISTERS

OPEN-SCALE REGISTER

WRIGHT'S REGISTER

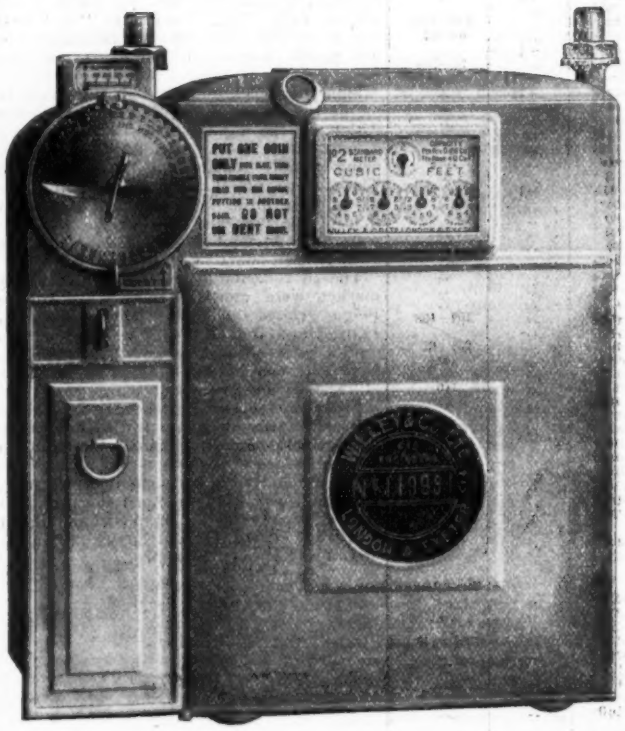
for OFFICIAL TESTING PLACES, WORKS, DISTRICT. LABORATORY, and SHOWROOM

ALEXANDER WRIGHT & CO. LTD.
WESTMINSTER, S.W.1

Telephone: VICTORIA 120

Telegrams: "PRECISION, SOWEST LONDON"

PERFECTION.



All Mechanism and Coin Insertion Slot in Front.

Range 4 to 50 c.ft. per 1d., or *pro rata* for other Coin.

Valve Positively Opens at 4 c.ft.

Price Changed *in situ* by the most rapid method devised.

Cash Box holds up to 80s. in Coppers.

The Mechanism is of Extra Strength on the Interchangeable Principle of Fine Limits of Accuracy.

Try a Sample; we are confident of your approval.

NEW STANDARD PATTERNS SUPPLIED *EX* STOCK.

WILLEY & Co., Ltd.

Chief Offices and Works: St. THOMAS, EXETER.
London Offices and Works:
89-95, HERTFORD ROAD, KINGSLAND, N. 1.
Manchester Meter Works:
SAVILLE STREET, OXFORD ROAD.
Leicester Meter Works: ROWSLEY STREET.
Darlington Meter Works: VALLEY STREET.
Agents for Scotland: D. M. NELSON & Co.
20, West Campbell Street, Glasgow.

CONTENTS.

EDITORIAL NOTES.

Dry Coke: In Britain—And in America . . 779
Comfortable Lighting 780
An Unsurpassed Service 780
National Fuel and Power Committee—Deserved Acknowledgment—Efficient Salesmanship—Loss of Pressure in Meters—Big Steel and Coal Mergers 781

On the Electrical Side 782
Forthcoming Engagements 782
Personal—
Mr. John Terrace, M.Inst.C.E. 783
Obituary 783
Institution of Gas Engineers—Council Meeting 783
National Gas Council—Meeting of the Central Executive Board 783
Manchester District Institution of Gas Engineers—
Visit to the Oswald Street Gas-Works, Burnley 784
Dry Coke Cooling by the Sulzer Process at the Oswald Street Gas-Works, Burnley. By J. Herbert Clegg, F.C.S. 785
The Importance to Industry of Education for Commerce. By F. W. Goodenough, C.B.E. 791
The Dry Quenching of Coke. By D. W. Wilson 792
Yorkshire Junior Gas Association—
The Radiation of Heat from Gas Lighting Burners. By H. J. Hodsman, M.B.E., M.Sc., F.I.C. 794

London and Southern District Junior Gas Association—
The Evolution of the Gas Meter: 1815 to the Present Day. By A. T. Gilbert . . 797
Gas Fire Progress 801
The Swiss Gas Association 802
Water Pollution—Report of the Water Pollution Research Board, 1927-28 802

CORRESPONDENCE.

The Gas Lighting Load 802–3

REGISTER OF PATENTS.

Applications for Patents 803

PARLIAMENTARY INTELLIGENCE.

House of Commons—
South Metropolitan Gas Company—Fuel Research 803
Low-Temperature Carbonization . . . 803
Safeguarding—Gas Mantles 803

LEGAL INTELLIGENCE.

John Wright & Eagle Range, Ltd., *v.* General Gas Appliances, Ltd.—Appeal Dismissed, with Costs 803

MISCELLANEOUS NEWS.

Birmingham Gas Department—Loans for Mains 804
Stockport Gas Tragedy—Resumed Inquest . 804
Gas *v.* Electricity—Debate at Torquay . . 804
Teignmouth's Scale of Discounts 805
Sampling and Analysis of Coal 805
Gas Regulation Act Applications 805
Diaries, Calendars, &c. 805
Coal Trade Reports—
North-East Coast 805
Yorkshire and Lancashire 805
Midlands 805
Current Sales of Gas Products 806
Trade Notes 806
Contracts Open 806
Stock Market Report 807

PARAGRAPHS.

"Definitions and Formulæ for Students"—Midland Association of Gas Engineers and Managers 790
South Suburban Gas Company's Reduced Price—Smoke Abatement Committee Visit Leeds Works—Rebates at Bradford—Further Reduction in Price at Burnley—New Plant at Hereford—Newport Reject Marsh Trustees' Offer—Opposition to Electric Street Lighting at Otley—Lecture on Gas Lighting at Warrington 806

"JOURNAL" OFFICE TELEPHONE.

The "Journal" Office Telephone Number is "Central 6055."

For List of "JOURNAL" Advertisers, see p. 810.

I

Under the stairs, within the meter, functioning well and economically, aluminium strip.

II

In the kitchen, cooking hygienically, saving labour in lifting, heating uniformly, avoiding waste of gas, aluminium cooking utensils.

III

In hall and dining room, brightening fittings and showing the minimum of discoloration by the products of gas combustion, aluminium galleries and deflectors.

IV

In shopping centre, warehouse and works, lamps with light, economical and attractive aluminium bodies.

Have you had the B.A.C. handbook of aluminium data?

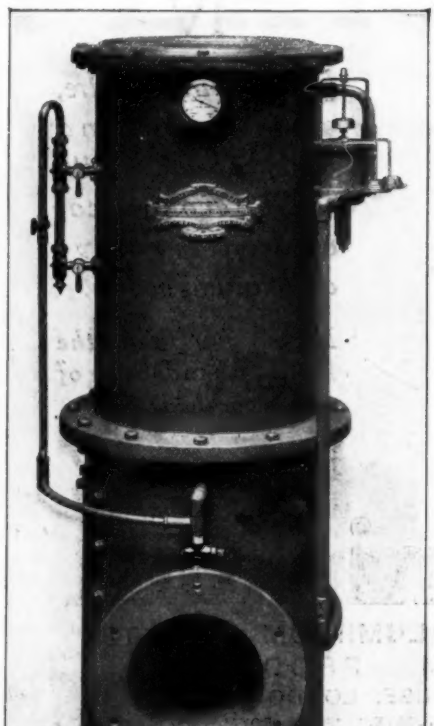
Aluminium

THE BRITISH ALUMINIUM CO., LTD.
ALUMINIUM PRODUCERS,
ADELAIDE HOUSE, LONDON, E.C. 4.
Tel.: "CRYOLITE, BILGATE." 'Phone: ROYAL 5561.

G.J. 19-12-28.

THE Thomas Glover was not the first of the prepayment meters but it was the first meter to use the price changer disc now adopted universally. Our plan with prepayment mechanisms has been to make them as fool proof as is humanly possible. Such a device has to be simple, sturdy, and positive in action. There must be no "back-lash" or slip in any direction. Furthermore, if the mechanism showed breakdown, the index of the meter must always be capable of accounting for the gas burnt. This is achieved on all our prepayment meters by the unique independent drives for index and prepayment mechanism.

Advertisement of Thomas Glover & Co., Limited.



PARKINSON'S GOVERNORS

PRESSURE-LOADED

COMPLETELY ENCLOSED
NO HEAVY WEIGHTS TO LIFT
PRESSURES UNLIMITED

W. PARKINSON & CO.,

INCORPORATED IN PARKINSON & COWAN (GAS METERS), LTD.

COTTAGE LANE, CITY ROAD, LONDON, E.C.1.	BELL BARN ROAD, BIRMINGHAM.	MORNINGTON STREET, ORMEAU ROAD, BELFAST.
Telegrams: "INDEX, ISLING, LONDON."	"GASMETERS, B'HAM."	"PREPAYMENT, BELFAST."
'Phone Nos.: 4270 Clerkenwell	2245 Midland, B'ham.	3374 Belfast.